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## CONTENTS


| | | |
|---|---|---|
| A Study of Merriam's Temperature Laws | By S. Charles Kendeigh | 129-143 |
| Life Zones, Modern Ecology, and the Failure of Temperature Summing | By Victor E. Shelford | 144-157 |
| Snow and Goss, the Pioneers in Kansas Ornithology | By Mrs. H. J. Taylor | 158-169 |
| Notes from Central Iowa | By Philip A. DuMont | 170-177 |
| Editorial | | 178-179 |
| General Notes | | 180-189 |
| Membership Roll | | 190-192 |



## THE WILSON BULLETIN

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# THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY

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## A STUDY OF MERRIAM'S TEMPERATURE LAWS*


BY S. CHARLES KENDEIGH


In 1894, Dr. C. Hart Merriam, of the United States Bureau of Biological Survey, formulated laws of temperature control for the northward and southward distribution of terrestrial animals and plants. At the time that these laws were formulated, they were, undoubtedly, the best statement of the known effect of temperature on limiting distribution. Much work of an ecological nature has since been done, however, and a reëxamination of these laws is needed.

### Statement of Temperature Laws

*General Considerations.* Dr. Merriam was concerned only with the factors of climate which are effective in limiting the distribution of plants and animals during the season of growth and reproduction, which is the open or summer season. He assumed that this season is the only part of the yearly cycle in which temperature exerts a limiting effect upon the distribution of plants and animals, as at other seasons sensitive organisms either become dormant, go into hibernation, or migrate.

Largely on the basis of previous work in the field, Merriam assumed that temperature is by far the most important factor limiting the northward and southward distribution of organisms. He then endeavored to determine which phase of temperature was the critical one by ascertaining what isotherms, when plotted on a large scale map of North America, most nearly agreed with the boundaries of his biotic units, the "life zones", then also in the formative period. The life zones represented unit areas of distribution, each characterized by possessing peculiar genera of animals and plants. If certain isotherms agreed with the boundaries of the life zones, then those isotherms, he argued, must represent the true factor of temperature which controlled the distributional limits of the animals and plants contained therein.

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*Contribution from the Baldwin Bird Research Laboratory (No. 23) and Western Reserve University, Cleveland, Ohio.

*First Temperature Law.* After trying and discarding the use of mean temperature for the reproductive period, use was made of the century-old idea of summation of temperatures. This idea is based upon the belief "that the same stage of vegetation is attained in any year when the sum of mean daily temperatures reaches the same value". A method of summing mean daily temperatures was worked out, and temperature summations were determined for a large number of stations scattered across the continent. When lines (isotherms) were drawn connecting localities with equal sums of temperature, these lines coincided satisfactorily with the northern boundaries of the life zones. He therefore formulated his first temperature law, "*Animals and plants are restricted in northward distribution by the total quantity of heat during the season of growth and reproduction*".

*Second Temperature Law.* Although these isotherms, so drawn, appeared to agree fairly well with the northern limits of distribution of plants and animals in the life zones, they did not coincide so closely with the southern limits of more northerly forms, notably near the Pacific coast. Wishing to determine the effective phase of temperature which limits the southward distribution of animals and plants, Merriam next plotted the mean daily temperature of an arbitrary period of six weeks during the hottest part of the summer. Isotherms formed from these data agreed with the southern boundaries of the life zones. This led to the formulation of the second temperature law, "*Animals and plants are restricted in southward distribution by the mean temperature of a brief period covering the hottest part of the year*".

*Table of Zone Temperatures.* Included in his paper is a table giving the critical temperatures which are supposed to limit the northward and southward distribution of organisms. For instance, the northern limit of the Transition Life Zone is determined by a sum total of mean daily temperatures amounting to approximately 10,000° F., the Upper Austral Zone by 11,500° F., the Lower Austral Zone by 18,000° F., and the Tropical Zone by 26,000° F. The southern limit of the Arctic Zone is determined, he supposed, by a normal mean temperature of 50° F. during the six hottest ,consecutive weeks, the Hudsonian Zone by 57.2° F., the Canadian Zone by 64.4° F., the Transition Zone by 71.6° F., and the Upper Austral Zone by 78.8° F.

*Importance of Humidity.* Three of the life zones were later divided at about the 100th meridian into eastern and western portions. This was based largely upon a very noticeable difference in humidity.

The east and west divisions are, however, of subordinate rank compared with the zonation north and south.

*Acceptance of Laws.* These temperature laws were accepted by some biologists, particularly by ornithologists and mammalogists, but not so generally by other zoologists nor by botanists.

## The First Temperature Law

It is necessary to consider each temperature law separately, since they are quite different, and criticisms applied to one do not necessarily apply to the other. The first temperature law assumes that summed daily temperatures during the reproductive season control northward distribution.

*Season of Temperature Effectiveness.* The reproductive and growing season is not, as Merriam supposed, the only time when temperature may be effective in controlling the distribution of animals and plants. Even though some of those forms which do not migrate may become dormant in winter, they are still not insensitive to extreme climatic conditions.

Shreve (1914) studied the relation of winter temperatures to the vertical distribution of vegetation in Arizona and found that "the greatest number of consecutive hours of freezing temperature is the factor most closely corresponding in its distribution, with the limitation of the species concerned". Experimental work with succulent species showed that those which have the lowest vertical limit of distribution were unable to resist freezing over 19 to 22 hours in duration. According to Salmon (1917), the isotherm of 10° F. for the daily minimum temperature of January and February coincides, in general, with the boundary of winter wheat culture in the United States. Northern evergreen trees resist winter-killing by increasing the osmotic pressure and water-retaining capacities of their leaves (Gail, 1926). Some plants are capable of initiating hardening processes to enable them to withstand low temperatures, while others are not (Rosa, 1921).

Hardening, to resist low winter temperatures, occurs also in some species of insects (Payne, 1926). This enables certain species to survive in regions where others, lacking this capacity, can not do so. Sanderson (1908) made a particular study of the influence of winter temperature in controlling the northward distribution of insects. He found that several species are absent from regions where the summation of temperatures during the summer is amply sufficient to allow their reproduction, but where minimum winter temperatures do not permit their survival, even though they are in hibernation.

With birds that migrate south for passing the winter, temperature is undoubtedly of significance in limiting their breeding range only during the open season. However, the wintering range of these birds may often be influenced as much by temperature as is the breeding range and in a similar manner (as in the case of *Troglodytes aedon aedon*), so that temperature is effective, as far as the birds are concerned, at all seasons of the year. Likewise, with birds and mammals which have never acquired the habit of migration but are permanent residents in a region, low temperatures of winter are of utmost importance and undoubtedly exert at that time as much or more influence in determining the distributional limits of the species than they do in the summer. These points are strongly substantiated in a paper which we have ready for publication but unable to include here (Kendeigh, Ms.).

In temperate regions, seasonal changes in the aspects of biotic communities is one of the most striking of ecological phenomena. Nearly all animals and plants undergo differences in behavior and physiology as the winter season comes on. This may be merely an increase in the resistance to low temperatures which occurs in evergreen trees, cold-blooded organisms, and in those birds and mammals which remain active in the region throughout the year. Or it may consist in the shedding of the sensitive leaves of deciduous trees, the production of seeds and dying down of annual plants, the going into hibernation of mammals and cold-blooded animals, or the migrating of birds. Species vary in their responses and resistances. Those that can not make the necessary adjustments can not exist, and so are not found in the regions where unfavorable conditions occur at some time during the year. Temperature must certainly be considered as effective at any time of the year, not just during the reproductive period. A temperature law that does not take this into consideration obviously can not be a complete nor even a true statement of the controlling role of temperature in distribution.

*Significance of Isotherms.* Merriam found a rather close agreement between the isotherms of accumulated daily temperatures with the northern boundaries of his life zones. This, he maintained, was a proof that they were the effective temperatures involved in limiting northward distribution. That this is not necessarily so is shown by the work of others.

Livingston and Shreve (1921), also using the cartographic method in much the same way that Merriam did, attempted to analyze the temperature factor in all its phases as it affects the distribution of

plants. They considered Merriam's temperature laws and life zones in detail. The aspects of the temperature factor which they considered were: duration of average frostless season; duration of average frost season; length of period of high daily mean temperatures; length of period of low daily mean temperatures; summation of daily mean temperatures above 0° F., 32° F., 39° F., and 50°F.; summation of exponential indices of temperature efficiency; summation of physiological indices of temperature efficiency; absolute temperature maxima; absolute temperature minima; average daily temperature during fourteen coldest days of year; Merriam's average temperature during hottest six weeks of year; and mean annual temperature. With all of these different aspects of the temperature factor, they found an east and west zonation of temperature across the continent. By selecting the proper isotherms, agreement in nearly all instances with the boundaries of the life zones can be had in a rough way. The selection of any one of these phases of the temperature factor, to the exclusion of the rest, as the effective one in controlling distribution, is not warranted without a basis in the physiological and behavior responses of the organisms concerned. This is the next point that needs to be considered here.

*Summing Temperatures.* Probably Merriam was right in assuming that the completion of any growth stage or mature organism requires a certain more or less definite amount of energy transformation. Krogh (1914) found this to be true for the pupal development of a beetle, *Tenebrio*, as measured by the total carbon dioxide output, and this output is not directly proportional to the temperature. In regions where the season is too short to allow the accumulation of the necessary amount of energy for the development of an organism, that organism could not, of course, be a regular member of the biota there. One may easily imagine that this may be one out of several factors effective in limiting the distribution of cold-blooded (poikilothermic) organisms (but not warm-blooded or homoiothermic ones as will be shown later). The difficulty comes in developing methods for computing this energy.

Merriam attempted to compute this energy requirement by the direct summing of daily mean temperatures above a certain threshold. Merriam quotes DeCandolle's work in 1835 as showing that wheat does not germinate at temperatures below 43° F. (6° C.), and so this temperature is the threshold for development in this species. Assuming that this temperature threshold is the same for all plants and animals and in all localities, Merriam's idea was to substract 43° F.

(6° C.) from the mean temperature for each day during the entire reproductive season. These temperature remainders would all be added together, and the resultant figure was to represent the total heat (in degree-days) available for development. By summing the effective temperatures in this way at a large number of stations he could arrive at totals characteristic of each life zone. Since different species of plants and animals apparently require different amounts of heat (energy) for their development, those that require the most would, he argued, be confined to the more southern life zones, while those that could get along with less would flourish in the more northern life zones. This is the physiological assumption for his first temperature law, the errors in which are pointed out in detail by Shelford in the succeeding paper.

However, there are criticisms that may be brought against this method of computing the total heat or total energy required for development in addition to those discussed by Shelford. The first of these is in regard to the selection of 43° F. (6° C.) as a threshold for development. The temperature threshold of development and activity is not the same for all organisms. Sanderson and Peairs (1913) estimated that the threshold value for the development of insect eggs and pupae varied from 37° F. to 52° F. in the case of different species. DeCandolle, himself, is quoted to have found seeds of some plants germinating at 32° F. while others, as corn, did not do so below 48° F. In the case of the development of eggs of the domestic fowl, the threshold temperature is 68° F. (Edwards, 1902). Likewise the initiation and termination of dormancy (hibernation and aestivation) in mammals has been found to occur at different temperatures and under different conditions (Johnson, 1931).

The temperature threshold may not be a constant value even within the same species. Shelford (1927) found that in the development of the codling moth the true temperature threshold is not a fixed point but varies, within certain limits, with the humidity and other weather factors, and also with the generation and the individual. For the larva, it was found to vary from 43° to 48° F.; for the pupa and egg, from 44° to 49° F.; and for the hibernated larva, from 43° to 50° F. We have reason to believe, also, that the temperature threshold is lower for plants and animals at high latitudes and altitudes than it is for those living in warmer regions. The error of selecting at random the threshold value for one species to hold for all forms in all localities is therefore manifest.

The table of summed daily temperatures (discussed above) which Merriam presents in his paper and which was used as the basis for drawing his isotherms is incorrect. This was due to a misunderstanding with the U. S. Weather Bureau, which computed the temperatures. The error in these computations was not discovered until later (Merriam, 1899), and no corrected table has since been published. The temperatures were summed above a threshold of 32° F. (0° C.) instead of 43° F. (6° C.), although only for days when the mean temperature arose above 43° F. (6° C.). Consequently the table of summed temperatures which Merriam gives is much too high, as Shelford points out graphically in the succeeding report. The agreement between Merriam's isotherms and the boundaries of the life zones is not a proof, therefore, of the correctness of his arguments—rather the contrary.

Various methods have been devised for summing temperatures above a definite threshold. The earliest method, and that which Merriam used, was formulated by Reaumur (1735) who summed temperatures above freezing for the years 1734 and 1735 and correlated these temperatures with the difference in the time of appearance of plants and animals during these two years.

From the practical standpoint, this method is criticized because the sums which it yields are too variable. Seeley (1917) summed temperatures above 43° F. from January 1 to the date of ripening of the Crawford peach at Wauseon, Ohio, for the years 1883 to 1912. He obtained sums during certain years as widely different as 3030° and 4347° F. He therefore declares that this method has no great value. He further emphasizes the importance of considering the temperature of the plant itself rather than of the air when studying the influence of temperature on growth. Likewise, Hunter and Hooker (1907) determined the total "effective temperatures" for the hatching of eggs of the cattle tick, by direct summing of temperatures above 43° F., and found that eggs laid from September 15 to October 15 require a total of 837.6° to 1510.8° F. to hatch, while those laid in April and May require 981.6° to 1139.1° F.

Livingston and Shreve (1921) and Shelford (1927, 1929) have severely criticized from the physiological viewpoint the method of direct summing of air temperatures for ascertaining the accumulation of energy for development. This is based on the fact that the rate of development varies widely at different temperatures. The inaccuracy of the method of direct temperature summation is fully dealt with in the following paper and so will not be discussed further here. The

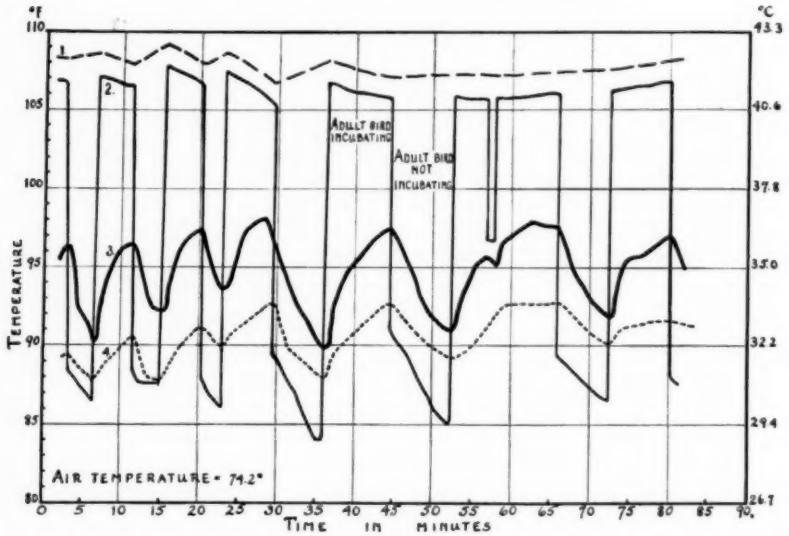


FIG. 27. Natural fluctuations in temperature of a House Wren egg under normal conditions in the nest. Curve 1 represents the body temperature of the adult bird; curve 2 is the temperature in the nest above the eggs, both when the bird is incubating and when she is away; curve 3 shows the temperature of the egg; and curve 4 shows the temperature in the nest beneath the eggs.

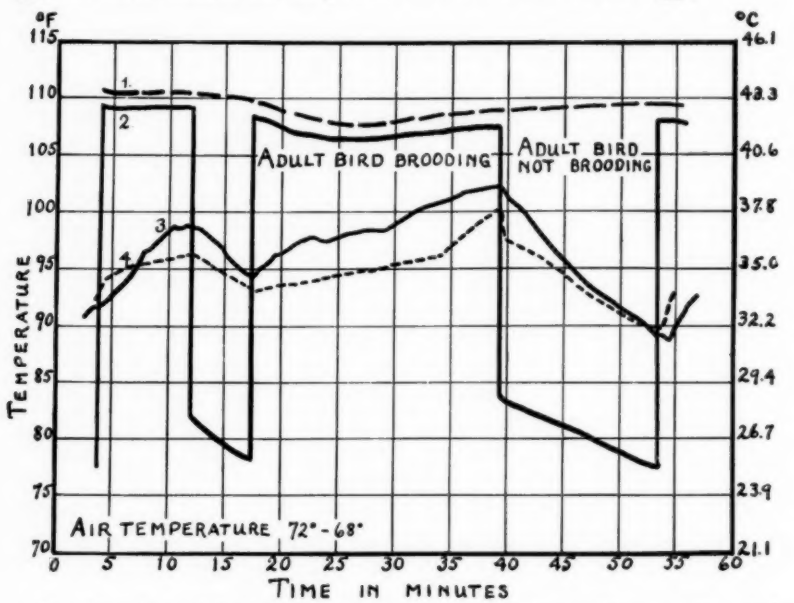


FIG. 28. Natural fluctuations in temperature of a House Wren nestling under normal conditions in the nest. Curve 1 shows the body temperature of the adult bird; curve 2 shows the temperature in the nest above the nestling, both when the adult bird is brooding and when she is away; curve 3 shows the temperature of the nestling; and curve 4 is the temperature of the nest beneath the nestling.

complexity of the problem is evident, and much more work needs to be done before the actual limiting effect of "total heat" during the season of reproduction may be adequately conceived.

*Temperature Tolerance by Birds.* A certain rather definite total of energy is probably as necessary for complete embryonic development of birds as it appears to be for the development of other animals (Krogh, 1914; Shelford, 1927). Bohr and Hasselbalch (1900) measured the rate of carbon dioxide output at all stages of the development of the domestic fowl, and similar studies have been performed by others (see Needham, 1931). The subject is capable, therefore, of experimental proof and measurement. Bird's eggs develop to hatching within a narrow temperature range. They are dependent, therefore, upon suitable conditions for maintaining them within this range.

Merriam's temperature law assumes that a sum of environmental temperatures is required before this total energy required by the bird's egg for development can be obtained. Actually, however, the temperature of the bird's egg in the nest is maintained several degrees above that of the air and is relatively unaffected by outside environmental temperatures. This is well shown in figure 27, which is taken from a forthcoming paper (Baldwin and Kendeigh, 1932) where the subject is discussed in detail. Likewise, the temperature of nestling birds is not directly dependent upon that of the outside environment (Fig. 28). The reason for this is that the adult birds have evolved a complicated nest and reproductive behavior that keeps nest conditions, particularly those involving temperature, at what is probably the optimum for the species. As long as the adult birds are able to survive and carry on normal activities in a region, they can maintain the requisite conditions required for the proper development of the young regardless of any accumulation of environmental temperatures without. This constitutes one important difference in the developmental history of warm-blooded and cold-blooded organisms, since the latter alone are directly dependent upon environmental temperatures for furnishing the energy needed in development. Thus summed environmental temperatures, even if such summed temperatures could be correctly determined in a significant manner, cannot possibly limit the distribution of birds through affecting development. Temperature appears to limit the northern distribution only when it affects the adult, and here other aspects of temperature are more important.

Some ornithologists have interpreted Merriam's laws as meaning that a certain sum of environmental temperatures during the season is

required before the adult bird is able to complete its entire nesting cycle. This idea is without adequate physiological basis for warm-blooded animals. As long as temperatures are above the limit of tolerance for the existence and carrying on of normal activities by the adult birds, the exact degree of heat, while it has some importance, is not of primary significance. Birds have been found in our studies of body temperature regulation to have efficient physiological mechanisms that compensate for variations in environmental temperatures and maintain constant body temperatures (Baldwin and Kendeigh, 1932).

The length of the season when temperatures are above the threshold for development and activity of cold-blooded animals and of plants or above the limit of tolerance for adult birds and mammals is quite a different matter from the summation of daily temperatures during this period. The season may be too short for allowing the completion of the entire reproductive cycle of activities. This may conceivably determine whether the bird will raise each season two broods, one brood, or none at all. It is only when the temperatures go beyond the limits of tolerance that birds are incapable of reproducing or of existing in the region and are limited in their distribution.

Birds possess a limit of tolerance to low air temperature when this factor acts in conjunction with long periods of time during which the obtaining of food is difficult. We have made an intensive study of temperature resistance of birds (Kendeigh, Ms.). These studies indicate that the average night temperature combined with the number of hours of darkness, when the procuring of food is impossible for most birds, are crucial and critical factors involved in controlling the northward distribution, the migration, and the abundance of birds. This is particularly true of the smaller passeriform species. Larger and heavier birds may have a greater resistance to low temperature than do the smaller birds, and this can be measured. Some factors other than temperature are correspondingly more important with the larger birds than the smaller ones, although other factors must be considered also in the case of all species.

*Other Factors.* Other factors aside from temperature may be of more or less critical importance in limiting the distribution of plants and animals. Undoubtedly, different factors have diverse degrees of importance with different species. It is advisable to study each of these other factors separately for each species of birds before broad generalizations be made concerning whole faunas. Our own experiments with birds emphasize the importance of such other factors as

relative length of day and night, intensity of solar radiation, vegetation, food, and biotic competition (Kendeigh, Ms.). Livingston and Shreve (1921) have discussed the importance of many different factors in relation to the distribution of plants; Grinnell (1914, 1917, 1928) and Howell (1922, 1924) have done the same for mammals and also birds.

*Summary.* The criticisms against Merriam's first temperature law as it applies to both animals and plants may be summarized as follows:

(1) Temperatures at other times of the year than the season of growth and reproduction may be effective in limiting the northward distribution of organisms.

(2) The mere cartographic agreement between particular lines of equal temperature (isotherms) and boundaries of life zones or other biotic areas does not in itself without adequate physiological basis constitute proof that such particular factors are the critical ones limiting distribution.

(3) The physiological basis of summing temperatures, which Merriam used, is without significance because (a) the temperature threshold of development varies widely in different species, and so, no one value which is not an average for each locality can be used; (b) temperatures, as they affect in a significant manner the development of plants and animals, cannot be summed directly because of marked differences in the rate of development at different temperatures; and (c) no distinction between cold-blooded and warm-blooded organisms is made in the possible effect of environmental temperatures upon development.

(4) The actual statistical climatic data used by Merriam to support his arguments and to prove the relation between temperature and the distributional boundaries of the life zones were incorrectly determined.

(5) Other phases of the temperature factor or other factors aside from temperature are of importance in limiting the northward distribution of animals and plants.

## The Second Temperature Law

The arguments concerning Merriam's second temperature law will be only briefly summarized here. This law states that the southward distribution of plants and animals are limited by the mean temperature during the hottest part of the summer.

*Isotherms.* The same criticism which holds against the method of Merriam in demonstrating the first temperature law applies also in the case of the second temperature law. The mere agreement between

particular isotherms and limits of distribution does not, without adequate experimental and physiological basis, constitute proof that such factors are the most critical or controlling ones.

*Maximum Temperatures.* In our study of the physiology of bird temperatures (Baldwin and Kendeigh, 1932), we found that variations in the mean temperature of the air from day to day have very little effect upon body temperatures of birds, even during the hottest period of the summer. However, during periods lasting from one to a few hours, the temperature of the bird may rise and normal nesting behavior be greatly disturbed due to exposure to the sun or to maximum daily air temperatures. Experiments performed with English Sparrows (*Passer domesticus domesticus*) and Eastern House Wrens (*Troglodytes aedon aedon*) indicate that high air temperatures become significant only when they get as high as 93° F. (Kendeigh, Ms.). At air temperatures above this degree the resistance time of birds decreases, body temperature may rise, the general metabolism is abnormally disturbed, and normal reproductive behavior interferred with. These two species of birds frequently survive air temperatures above 93° F., but only when these temperatures are maintained for relatively short periods each day and only by modifying their normal behavior. Birds have, therefore, upper limits of temperature tolerance as well as lower limits, and these are effective in controlling distribution (Kendeigh, Ms.).

However, these high air temperatures usually do not persist for more than a few hours each day. They are the maximum daily temperatures. The mean daily temperature, even during the hottest part of the summer, is considerably lower, because the nights are cooler. On the basis of these experimental results and careful analysis of the temperature factor in the field, the conclusion appears warranted that the maximum daily temperatures, rather than the mean, are more important in controlling the southward distribution of birds. We may suppose that the same is true with other kinds of organisms.

*Other Seasons.* Merriam limited the influence of high temperature to the hottest part of the year (six weeks). While high temperature is undoubtedly of considerable significance at this time, especially in the control of the breeding range, its possible effect at other seasons must not be excluded. High temperatures may have an influence in determining the southward distribution of northern birds in the winter, although there is little conclusive evidence on this point. Likewise, during both the spring and fall migrations, the distribution of a species at any one time may be influenced by high temperatures.

*Other Factors.* Mention needs to be made again that other factors aside from temperature (such as those enumerated above) may often exert an important role in controlling the distribution of birds and other organisms, even in a southerly direction (Grinnell, 1914, 1917, 1928; Howell, 1922, 1924; Kendeigh, Ms.; Livingston and Shreve, 1921).

*Summary.* The arguments against Merriam's second temperature law maintain that:

(1) The mere agreement between isotherms and the distributional boundaries of life zones is not proof without adequate physiological basis that such factors are the controlling ones in distribution.

(2) Daily maximum temperatures are more important than daily mean temperatures in controlling the southerly distribution of birds and probably other organisms.

(3) High temperature may influence the distribution of organisms at other seasons of the year than just the six hottest weeks during the summer.

(4) Factors other than temperature are also important.

## Temperature Laws and Life Zones

If Merriam's temperature laws can not be accepted and used, the question may be raised as to what effect this will have upon the reliability of the "life-zone" concept and the maps of life zones that have been made by ornithologists and mammalogists.

It is difficult to estimate to what extent these temperature laws have influenced the mapping of life zones. It is certainly true that Merriam published two life zone maps of North America (Merriam, 1890, 1892) before he definitely published the temperature laws in 1894. The earlier maps seem to have been based largely upon the known distribution at that time of genera of plants and animals, although the importance of temperature was even then appreciated. Certain modifications in the maps published in 1894 and later years suggest that after the isotherm map was made, secondary changes in the boundaries of the life zones may have been thought advisable. Only in so far as the life zones are based upon these temperature formulae of Merriam, is their inadequacy questioned at this time. If the life zone concept is to continue to exist, it must be entirely upon the basis of the actual distribution of animals and plants. Recent maps of life zones appear, as far as we can judge, to be based largely upon actual distribution of organisms, although the organisms selected to characterize the different life zones are frequently of such minor

importance and abundance as to be without significance for correlations with climatic conditions.

## Conclusions

1. Merriam's two laws of temperature control for the northward and southward distribution of animals and plants cannot be accepted.

2. The life zone concept, in order to survive, must be based upon the actual distribution of important and significant animals and plants in nature and not upon climatic factors of uncertain preconceived importance.

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# LIFE ZONES, MODERN ECOLOGY, AND THE FAILURE OF TEMPERATURE SUMMING*

BY VICTOR E. SHELFORD

I. Introduction.

II. Fundamental Basis of Merriam's Work.

III. Relation to Physical Conditions.
1. Merriam's View.
2. Experimental Results.
3. Analysis by students of plants.

IV. Relations of the Zones to Communities and the Major Facts of Distribution.

## Introduction

There is a large degree of confusion as to the relations of life zones as originally described by Merriam, and the plant-animal communities recognized in modern ecology. There are two points of view in the study of distribution: (1) the faunistic-floristic view which bases its principal regions on genera, is purely qualitative and aims at the discovery of facts bearing upon evolution and migration as considered in this field; (2) the ecological point of view which bases its communities (regions) upon species and varieties, is purely quantitative, evaluating all important organisms on the basis of quantity and individual potency, and aims at the discovery of facts bearing on dynamic life relations of all kinds—fluctuations in abundance, competition, invasion, succession, etc. In order to compare this viewpoint with that of Merriam and his followers, it is necessary to go back to the initial thesis of Merriam (1891) and trace its later developments.

## Fundamental Basis of Merriam's Work

Merriam began his work as strictly a faunistic study. His remarks in his original presentation of his subject were directed mainly as a criticism of Wallace (*Geographical Distribution of Animals*, 1876), whose distribution of regions is shown in figure 29. Zoogeographical regions as worked out by Wallace and many others are based upon genera or families, no consideration being taken of the abundance, habitats, or habitat relations of the animals. The aim was to clarify (historical) evolution, migration, and barriers. Merriam set out to prove that Wallace's mapping is incorrect, constructing a table given below (Fig. 30).

*Contribution from the Zoological Laboratories, University of Illinois, No. 426.

FIG. 29. The sub-regions of Wallace, 1876.

FIG. 30. Merriam's Life Zones, after Anthony.

TABLE I.

Generic Basis of Zones.

| | Mammals | | Birds | | Total | |
|---|---|---|---|---|---|---|
| | Families | Genera | Families | Genera | Families | Genera |
| Arid Sonoran distinguished from humid Sonoran by..... | 1 | 10 | 0 | 24 | 1 | 34 |
| Humid Sonoran distinguished from arid Sonoran by..... | 1 | 4 | 0 | 7 | 1 | 11 |
| Common to both arid and humid Sonoran ..... | 13 | 27 | 12 | 31 | 25 | 58 |
| Sonoran as a whole distinguished from Boreal by..... | 8 | 41 | 10 | 100 | 18 | 141 |
| Boreal as a whole distinguished from Sonoran by..... | 6 | 30 | 3 | 40 | 9 | 70 |
| Common to Boreal and Sonoran ..... | 8 | 8 | .... | 18 | .... | 26 |

In this table Merriam showed that more genera are different from north to south than from east to west. The comparison is made between his Boreal and his Sonoran regions for the north and south difference and between the arid and humid portions of the Sonoran for the east and west difference. This agrees with Wallace in one feature of the latter's classification, but disputes his division into Californian, Rocky Mountain, and Alleghanian areas, as shown in Wallace's map (Fig. 29). In other words he practically called Wallace's 1, 2, and 3 (Fig. 30) *Sonoran* and Wallace's Canadian, *Boreal*. He then used these conclusions to disprove the subdivision into Californian, Rocky Mountain, and Alleghanian sections, but presented no table to establish his three transcontinental divisions, namely the Transition, upper Sonoran (or Austral) and lower Sonoran (or Austral). He contended, however, that within the Sonoran zone there are more generic differences from north to south than from east to west. In other words genera, which are the basis of the first subdivision of the large zoogeographical regions, range cross-wise of the North American continent.

## RELATIONS TO PHYSICAL FACTORS

1. Merriam's view and method. He had noted correlations between isotherms and distribution limits of birds and mammals, and contended that their limits coincide with certain temperature phenomena, particularly the total temperature above 6° Centigrade (approximately 43° F.). He insisted that temperature is the most important limiting factor, though no experiments were performed and no inquiries as to the method of its operation were undertaken. His sums of temperatures were calculated by the Weather Bureau. Through some error, those given him for publication were not calculated above 6° C. but above zero Centigrade, with all days in which the mean did not reach 6° C., *omitted*. A note was published in *Science* calling at-

tention to this error (Merriam '99), but the new totals were never substituted. The sums published are, therefore, unlike those compiled elsewhere.

This assumption of the sum of temperatures had received considerable attention in the few decades preceding the announcement of the Life Zone idea. Merriam, however, merely took the relation for granted

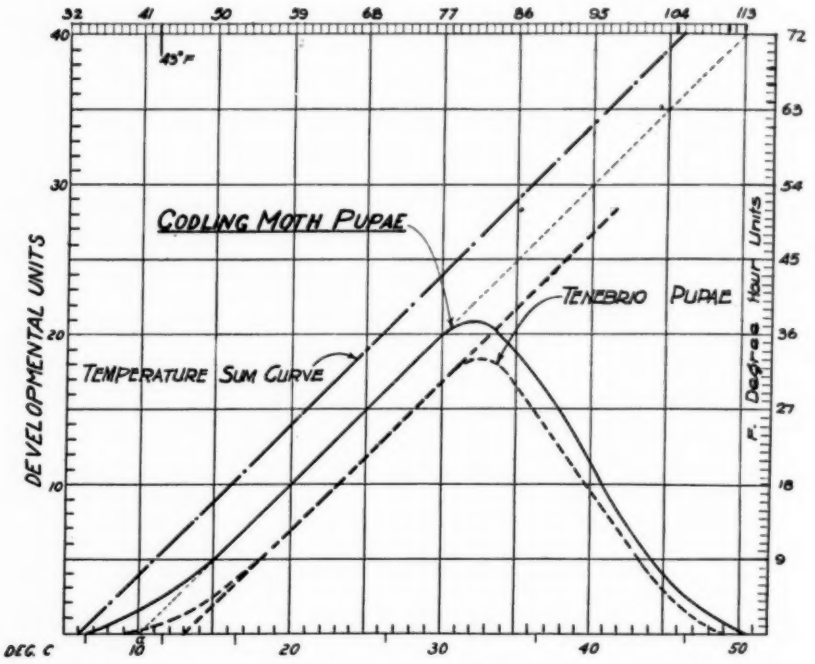


FIG. 31. Developmental curves: The dash-dot straight line is the rate of development curve assumed in summing temperature above 6° C. Compare with the curves of rate of development at different temperaturs for the pupae of the codling moth and the meal worm (*Tenebrio*) at the right. In connection with these two curves for insect pupae, an extension of the straight line portion is shown to indicate the failure of temperature summing. It will be noted that the straight line indicates a starting point marked *a* which is several degrees above the actual threshold, being at 10° for the codling moth and at 13° for the meal worm, while the actual threshold is three or four degrees lower. The velocity figures in Table II are read off on the scale at the left for each temperature on the horizontal scale.

without experimental or direct observational work on birds or mammals or plants, such as described by Kendeigh ('32).

Formulae for estimating daily means above a base, from the maxima and minima readings have long been in use, e. g. Strachey's 1887 formula (see Shelford '29, '30), but apparently were not utilized

by Merriam. It is well known that sums of temperature to be of biological significance must be based upon hourly or bihourly readings. The writer has further conducted extensive experiments showing that temperature sums are not a good index to rate of development or of other biological processes (Shelford '29), a fact originally pointed out by Krogh (1914).

2. Comparison of actual developmental rates and rates assumed in summing. The actual rates of development for the codling moth were determined in detail and checked against thousands of cases in nature. Figures 31 and 32 show the actual velocities of development as determined experimentally (codling moth, Shelford '25; meal worm,

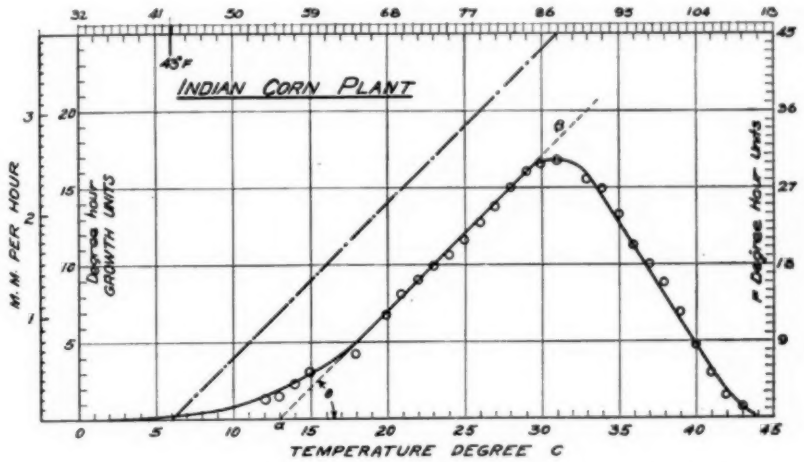


FIG. 32. The 6° summing curve in comparison with the actual rate of growth of the Indian corn plant, according to Lebenbauer (from Shelford '29).

Krogh '14, with extension to conform with the codling moth; Indian corn plant, Lebenbauer '14, and Livingston and Shreve '21). The units shown on the scale at the left equal the effect of one degree (C.) for one hour on all the curves. The straight lines (summation curves) are based on the assumption that the effect of one degree is the same at all temperatures.

The results of summing temperatures and developmental units (Table II) for two weeks, April 3-10 and August 28-September 4 (Fig. 33) are shown in Table III. In this table the sums made by the two-hour mean temperatures of figure 33 are divided by twelve to get the *degree days* and degree day developmental units of Table III.

## Table II

Table showing the rate of development expressed as the effect of one degree for an hour (developmental units) in the straight line portions of the velocity curves in figures 31 and 32.

| °C. | Meal Worm Pupa | °C. | Codling Moth Pupa | °C. | Indian Corn Plant |
|---|---|---|---|---|---|
| 3 | 0 | 3 | 0 | 3 | 0.05 |
| 4 | 0 | 4 | 0 | 4 | 0.10 |
| 5 | 0 | 5 | 0 | 5 | 0.2 |
| 6 | 0 | 6 | 0 | 6 | 0.3 |
| 7 | 0 | 7 | 0.2 | 7 | 0.4 |
| 8 | 0 | 8 | 0.5 | 8 | 0.6 |
| 9 | 0 | 9 | 1.2 | 9 | 0.8 |
| 10 | 0.2 | 10 | 1.7 | 10 | 1.0 |
| 11 | 0.6 | 11 | 2.1 | 11 | 1.2 |
| 12 | 1.2 | 12 | 2.7 | 12 | 1.7 |
| 13 | 1.8 | 13 | 3.3 | 13 | 2.0 |
| 14 | 2.4 | 14 | 4.1 | 14 | 2.5 |
| 15 | 3.0 | 15 | 5.0 | 15 | 3.0 |
| 16 | 3.6 | 16 | 6.0 | 16 | 3.5 |
| 17 | 4.2 | 17 | 7.0 | 17 | 4.3 |
| 18 | 5.0 | 18 | 8 0 | 18 | 5.0 |
| 19 | 6.0 | 19 | 9.0 | 19 | 6.0 |
| 20 | 7.0 | 20 | 10.0 | 20 | 7.0 |
| 21 | 8.0 | 21 | 11.0 | 21 | 8.0 |
| 22 | 9.0 | 22 | 12.0 | 22 | 9.0 |
| 23 | 10.0 | 23 | 13.0 | 23 | 10.0 |
| 24 | 11 0 | 24 | 14.0 | 24 | 11.0 |
| 25 | 12.0 | 25 | 15.0 | 25 | 12.0 |
| 26 | 13.0 | 26 | 16.0 | 26 | 13.0 |
| 27 | 14.0 | 27 | 17.0 | 27 | 14.0 |
| 28 | 15.0 | 28 | 18 0 | 28 | 15.0 |
| 29 | 16.0 | 29 | 19.0 | 29 | 16.0 |
| 30 | 17.0 | 30 | 20.0 | 30 | 16.7 |
| 31 | 17.8 | 31 | 20.5 | 31 | 17.0 |
| 32 | 18.2 | 32 | 21.0 | 32 | 16.8 |
| 33 | 18.3 | 33 | 20.7 | 33 | 15.7 |
| 34 | 17 8 | 34 | 19.8 | 34 | 14.0 |
| 35 | 17.0 | 35 | 18.8 | 35 | 12.7 |
| 36 | 15.4 | 36 | 17.5 | 36 | 11.5 |
| 37 | 14.2 | 37 | 16.1 | 37 | 10.0 |

## Table III

Table showing the application of the Merriam sums (sums above 0 with days at or below 6° C. omitted) of degree days, actual sums above 6° C., the progress of the meal worm pupa, of the codling moth pupa, and the growth of the Indian corn plant. Degree days may be compared with degree day developmental units in the case of the two insects.

| | April 3 to April 10, 1916 | July 28 to August 4, 1916 |
|---|---|---|
| 1. Sum of temperature (degree days) above 6° which are the assumed developmental units (See 3 and 4) | 8.0 | 154.0 |
| 2. Merriam's sum | 26.0 | 196.0 |
| 3. Degree day developmental units for the pupa of Tenebrio (See curve Fig. 31) | 1.6 | 97.5 |
| 4. Degree day developmental units for the codling moth pupa | 4.3 | 116.6 |
| 5. Growth of corn plant in mm | 9.7 | 326.5 |
| 6. Assumed growth for 6° starting point (in mm.) | 28.8 | 554.4 |
| 7. Assumed growth under Merriam's calculations (in mm.) | 93.6 | 705.6 |

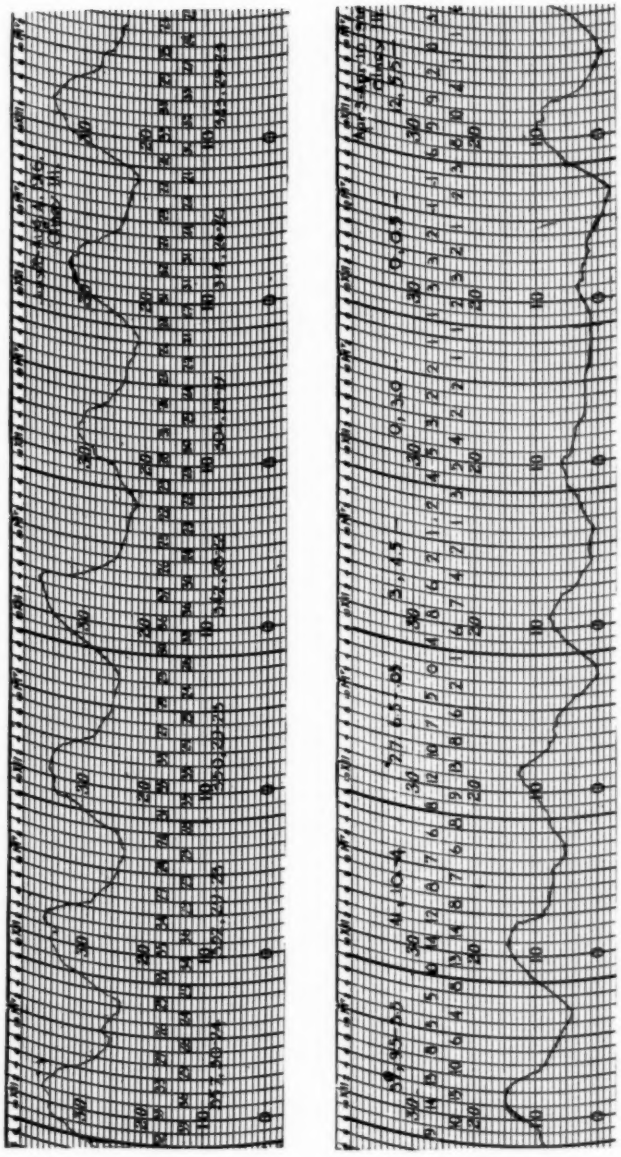

Fig. 33. A thermograph chart for a hot summer week is shown in the upper tracing of the figure. The mean temperature for each two hours is shown in the two-hour spaces. Below in the order named are the sums of two-hour means, the mean, and the mean less 6°. The lower tracing, for a cold week, shows the two-hour means, but the figures above are the sums of two-hour means less 6° for all two-hour periods in which the *mean* is more than 6°; this type of treatment is necessary in days in which there are two-hour periods with means below 6°. The mean daily temperature for this chart is derived as the mean of the maximum and minimum for the day, which is the method used in the U. S. Weather Bureau. The reader will find discrepancies between the mean temperature less 6° and the sum of two-hourly means less 6° divided by 12 to reduce to degree days. For example, on the last day the mean temperature is 5.5 but the sum of bihourly degrees is 12 and 1 degree day was accumulated though none was shown by the mean. In Merriam's accidentally erroneous summing the first three days would be included, but the last four days would not, because their means fall below 6°.

It will be seen from a study of the three rate curves that their form is radically different from the straight line assumption which rises at the same rate as the temperature rises. First the straight line type of curve does not begin until about one-fifth of the temperature range (compatible with growth) above the threshold or starting point has been covered. It then rises directly in proportion to the rise in temperature through about one-third the range compatible with life. The rate is rapidly retarded through the remainder of the life-compatible temperature range (less than one-half of the entire range). The 6° C. starting point is not far from the correct threshold temperature, but the rise in rate of growth or development does not begin to be proportional to the rise in temperature until 7° to 10° higher and ceases to be proportional at about 30° C. (86° F.). Figure 33 shows the bihourly average temperature for the week April 3-10, 1916, Olney, Illinois, and the week July 28-August 4, 1916, Olney, Illinois. For the warm week the sums of the two hourly means are shown for each day. The daily mean and daily mean above 6° C. are derived from the sum. For the cold week the sum of two hourly means *above* 6° C. are given, followed by the mean derived from the maximum and minimum and this mean less 6 degrees. There is considerable difference between this and one-twelfth the sum of two-hour means (see the fourth and seventh days).

The Tenebrio pupa requires 104 degree C. day units for completion and the codling moth 150 degree C. day units. The Merriam sum for the cold week is *fifteen* times as great as the actual progress of the Tenebrio pupa (compare items 2 and 3, Table III). Merriam's sum for the hot week is more than twice the actual progress. Comparing items 5 and 7, Merriam's assumed growth of the corn plant is nearly ten times the actual growth for the cold week and more than twice that for the hot week. The discrepancies due to the error in summing are large and those for the simple summing of temperatures are merely smaller. The sum-of-temperature assumptions are without scientific foundation and must be discarded.

3. Views of students of plants. Livingston and Shreve ('21) after a detailed analysis of climatic conditions (p. 528) in relations to plants, state: "From the preceding discussion, and from considerations presented in Part II, it appears that the system of life zones worked out by Merriam and now rather widely used in a descriptive way, especially by the United States Biological Survey, will require much modification before it may become at all satisfactory to a serious student of etiological plant geography. It is extremely unfortunate

that the actual data on which this system was originally based, and on which its applications are based in current descriptions, do not exist in the published literature. Neither Merriam nor any of his followers has thus far attempted to present the actual basis for the system in form such that a critical study of its good and bad features may be undertaken. Perhaps this may be a main reason why the whole subject of the climatic relations of floral and faunal areas has received so little attention at the hands of students who are able and willing to undertake the complex analyses which are involved in such a subject. The publication of the charts without the data on which they were based, together with the general and official adoption of the system by the United States Biological Survey, have given this important problem the appearance of having been satisfactorily solved —of being a closed subject. Those who have employed this zone system have either refrained from any discussion of its good and bad characteristics, or else they have merely taken the standpoint of advocates, and the lack of numerical data that are absolutely necessary for a critical study has tended strongly to discourage such inquiries. Also, a sort of authoritative atmosphere that seems to hang over government publications in general, together with the apparent authority and dogmatism that invariably go with well-printed (and especially colored) charts, to the exoteric reader, tend in the same direction, to retard real progress. Ecological students should realize that this is not by any means a closed subject, but that it is in a very early, formative stage, and that it requires vastly more critical and original study than has ever been accorded it."

## Relations of the Zones to Communities and the Major Facts of Distribution

On his expedition to the San Francisco Mountain in 1889 Merriam discovered the altitudinal zonation of plant and animal communities in that region and named them primarily after the vegetation. He recognized the Alpine Zone, Timber-line Zone, Spruce or Hudsonian Zone, Balsam Fir or Canadian Zone, Yellow Pine Zone, Pinon Zone, and the Desert Zone.

Starting with the San Francisco Mountain and with belts that correspond to vegetation, Merriam carried his zones across the continent on the basis of his temperature theory, cutting the major communities crosswise from west to east. Lengthwise, or from north to south, on the great plains grassland area, the dominant grasses belonging to several genera are distributed throughout. These are divided into three zones. Likewise, the bison, pronghorn antelope, prairie

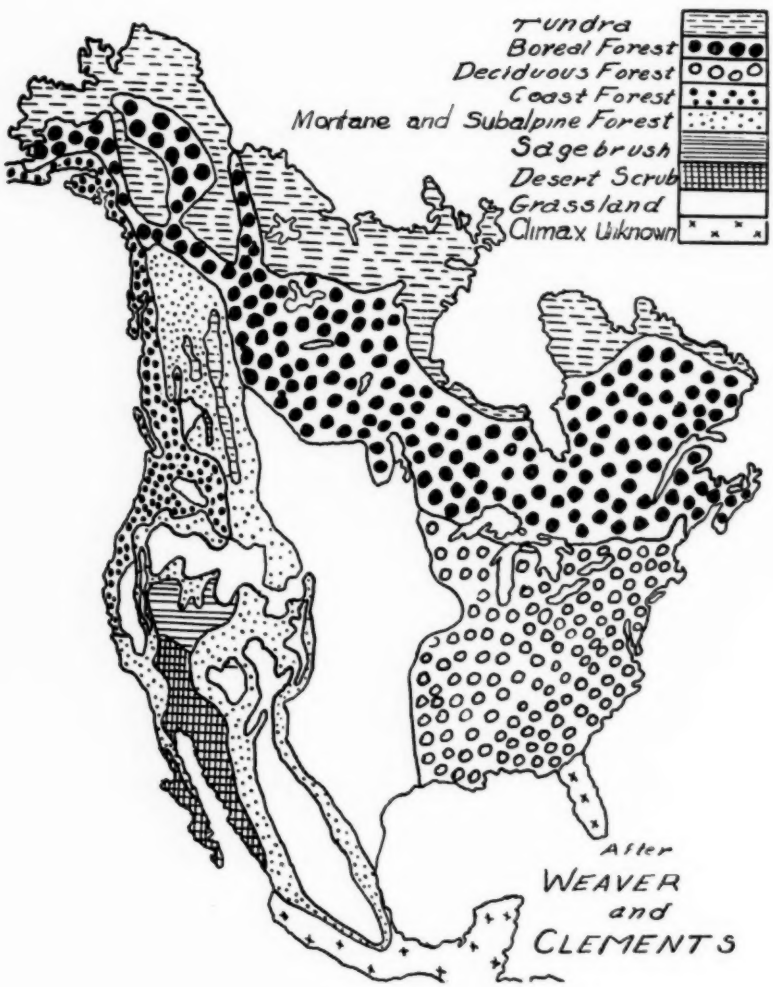


FIG. 34. Map of plant climaxes, modified from Weaver and Clement.

dog, kit fox, in fact, all the more important grassland animals, have their population divided between three zones, though constituting a part of our best known plant-animal formation (biome).

Where the great plant-animal communities are cut across by the life zones, *subclimax plants*, river margin shrubs, and *animals belonging to local conditions* have to be the main reliance as indicators. The trees and shrubs skirting the streams and animals such as the elk and grizzly bear which were found among them occasionally are used though their presence here is governed by soil and water and trees rather than climate. Again in a few cases biotically equivalent varieties of the same species may show relation to life zones. The zonal basis is, however, entirely a secondary matter. Similar violence is done the Deciduous Forest Community. The zones are quite generally out of accord with vegetation areas and natural communities over the southeastern third of North America. The Transition Zone, in particular, includes beech-maple forest, tall and short grassland, poplar parkland, chaparral, yellow pine forest, etc.

Disagreement of the major facts of distribution with the Merriam zones has been indicated by students both with taxonomic-faunistic viewpoint and with a quasi-ecological viewpoint.

Disagreement with the zones is indicated also for mollusca by Pilsbry and Ferriss ('06) in the following terms: "For the student of molluscan distribution, the life zones of the United States as mapped by Dr. Merriam emphasize the secondary and not the primary facts of distribution. The laws of temperature control, which he has developed with keen insight, do not define transcontinental zones of primary import zoologically. These zones are secondary divisions of vertical life areas of which the molluscan faunas were evolved in large part independently."

In his studies of the mammals of the Flathead Lake Region in Montana, Dice ('23B), after pointing out the correspondence of the faunas with those one to two hundred miles away, points out difficulties with life zones (p. 259) in the following terms:

"However, the correlation of these faunas with faunas of more distant regions offers greater difficulties, and little seems to be gained by trying to homologize the faunal area of the bunchgrass near Flathead Lake with the Alleghanian faunal area of the eastern United States in order to form a Transition life zone. The relationships of the lower coniferous forests near Flathead Lake to the Canadian fauna and those of the higher mountains to the Hudsonian fauna respectively of eastern North America are also somewhat remote."

Further, Dice ('23A) takes issue with the life zones in general with reference to the life zones of Alabama (Howell '21). On page 43 he states, "The life zones of Merriam are founded on the belief that there are zones of life extending transversely across the continent of North America, in the south as well as in the north. However, no species of mammal listed in this paper as characteristic of the Upper Austral Zone of Alabama is listed by Hall and Grinnell as characteristic of the corresponding zone in California." On page 47 he states, "The distribution of the species of mammals in the State of Alabama is not well shown by the life zone map presented. Only a relatively small percentage of the species known from the state agree closely in distribution with the boundaries of the life zones as mapped; and the presentation of such a life zone map gives an appearance of finality and precision to the classification of distribution which the facts do not justify.

"The recognition of transcontinental Upper Austral and Lower Austral Zones wrongly represents the faunal relationships of the parts of these zones mapped in Alabama and California respectively."

In the western mountains there is considerable agreement between the plant-animal communities and life zones. Grinnell ('14) has attempted to bring these two systems into harmony and has progressed a long way toward the modern ecological viewpoint, especially from the standpoint of biotic interaction. This would have been impracticable had he not been dealing with a mountain-dominated region, in which the life zones and biotic communities are quite generally in agreement.

As ordinarily presented in America, however, the two systems are so completely out of harmony as to viewpoint, that it is best to leave the life zones to the field of zoogeography, having for its aim the explanation of evolutionary phenomena, but with no ideas of modern community analysis or experimental work. The American life zone viewpoint has been carried so far in the United States Biological Survey that it has faced modern problems of biotic balance, relation to weather and other relations of agriculture, and grazing without suitable scientific foundation.

Modern ecology is concerned with the dynamics of communities. Their development in denuded or other new areas has occupied a large amount of attention and the final stage of this development is taken to stand out as the chief guide to such mappings as are shown in figure 31. Competition between *species*, both plant and animal, control of the habitat by organisms, fluctuations in abundance and their causes, are the chief interests of modern ecologists. Their work

has essentially little relation to the mere mapping of regions based upon a record of occurrence of genera, in which abundance, dominance, or influence of species in the community are matters of no concern. Such mapping comes into the field of ecology only when a consideration of the long historical development of the aggregations of species with changes in climate is sought.

European ecologists refer from time to time to North American life zones (Elton, '27, p. 11) as ecological regions. The Russian ecologists (Kashkarov '27, Filipjev '29B, and Kashkarov and Korovin '31) use life zones which correspond to the vegetation. Filipjev has mapped what is essentially the vegetation of Eurasia as *life zones*. The secondary and purely qualitative faunistic character of the life zones recognized in North America by mammalogists and ornithologists and their lack of agreement with natural ecological regions (communities) outside the western mountains has hitherto not been made clear to them.

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# SNOW AND GOSS, THE PIONEERS IN KANSAS ORNITHOLOGY

BY MRS. H. J. TAYLOR

A rich full life expresses itself through ever increasing avenues. It discovers the interrelation in all fields of knowledge and enters into them with courage and enthusiasm attaining an ever widening horizon of human understanding. When the spirit of such a life is set free it sheds a radiance on many fields of learning and investigation, and each claims it as the exponent of a particular field.

Francis Huntington Snow's was such a life. During his four college years he became a thorough student of the classics. A theological course at Andover Seminary increased his love for the classics and deepened his human insight. When he was called to Lawrence, Kansas, where the State University was about to open its doors, he looked forward to teaching the language and literature of the classics. Snow understood and met the needs of the fifty-five enrolled students. He taught mathematics, geography, and the beginnings of natural science. His love for and knowledge of Latin and Greek made a rich background but in the university of the world he became a geologist, a zoologist, a botanist, an entomologist, an ornithologist. This paper concerns itself primarily with F. H. Snow, the ornithologist.

Francis Huntington Snow was born in Fitchburg, Massachusetts, June 29, 1840. He died at Delafield, Wisconsin, September 21, 1908. He was buried in Lawrence, Kansas.[1]

In 1862, at the age of twenty-two years, Snow was graduated from Williams College. He was appointed valedictorian by the faculty, a singular honor among classmates such as Frank Carter, who in 1881 became president of Williams College, Professor George Raymond, and Professor E. H. Griffin, who with others, have attained distinction. The promise of Snow's young manhood was abundantly fulfilled in his sixty-eight years.

In Kansas the State University was coming into being. Its doors were to open in September, 1866. A call to occupy a chair in the new institution was, through the recommendation of Governor Charles Robinson, extended to F. H. Snow, and he became one of the three men constituting the first faculty of the University of Kansas. He remained active in this university until his death in 1908. He had served forty-two years. In 1881 Professor Snow received the degree of Ph. D. from Williams College, and that of LL. D. from Princeton in 1890. He was a member of the honorary societies of Sigma Xi and Phi Beta Kappa.

[1]From a letter received by me in September, 1931, from Professor Snow's daughter, Mrs. Martha Snow Brown.

FRANCIS HUNTINGTON SNOW, 1840-1908

A paper read by Doctor Snow before the Academy of Science at Topeka, January 2, 1903,[2] follows in part: "When the writer of this paper arrived in Lawrence, Kan., in the last week of August, 1866, about ten days before the opening of the State University, he took the earliest opportunity to call upon the chancellor of the University. He took it for granted that some preliminary arrangements would be necessary before the arrival of the important day which should usher into existence so important an institution as that with which he was to be connected as a member of its first faculty. The chancellor . . . informed him that nothing could be done until the opening day, and advised him to 'get a gun and go shooting'. This advice was conscientiously followed, with the result that the writer soon became deeply interested in the birds of Kansas, and began to prepare a catalogue. He had the entire field to himself, there being no other person in the state for several years who was known to him as having an interest in ornithology. He soon organized among his students an enthusiastic class in zoology, and instituted an ornithological survey. . . In . . . 1872, he published the first edition of his Catalogue of the Birds of Kansas, in the Kansas Educational Journal. The list of birds in this catalogue included 239 species and varieties, of which thirty-two species were inserted on the authority of Dr. T. M. Brewer, of Boston. . . I published no additional complete list of the birds of Kansas, having left the formal continuance of this work to my friend, Col. N. S. Goss, so long as he lived. Thus, all together, the author of this paper, during the last third of the nineteenth century, had catalogued 305 species and nine varieties of Kansas birds, or a total of 314 numbers or entries.

"Up to the year 1878 no other citizen of Kansas had published any facts regarding the birds of Kansas. In that year Col. N. S. Goss began his notes upon this subject in an article on the 'Breeding of the Duck Hawk in Trees.' . . . On July 25, 1879, he wrote me that he had in his collection 154 species of Kansas birds. . . . In the same year he made his first addition to the list of Kansas birds—Bonaparte's Gull. . . He continued to increase our knowledge of the bird fauna of Kansas until he had added thirty-one species and races to the list."

In 1881 Prof. Snow reported the capture of a "Snake-bird" in Kansas to Dr. Elliott Coues, who made it the subject of a note in the Bulletin of the Nuttall Ornithological Club.[4] Col. Goss, in his "His-

[2]Transactions of the Kansas Academy of Science, Vol. XVIII, p. 154.
[4]Bull. Nutt. Ornith. Club, 1882, Vol. VII, p. 61.

tory of the Birds of Kansas"[5] makes the following comments on this species:

"A rare summer visitant. . . This species was captured within the State, in the Solomon valley, in August, 1881, by Mr. C. W. Smith, of Stockton; and May 1st, 1888, Mr. Daniel Lambert, of Wilburn, Ford county, shot, in the northern part of Meade county, on Crooked Creek, five of the birds, out of a small flock that arrived a few days before and together. . . "

In 1913, C. D. Bunker published "The Birds of Kansas."[6] This report merely says of the Water-Turkey: "Catalogued as accidental by Doctor Snow. No Kansas collected specimen in the University Museum."

In the same paper the author says: "The study of Kansas birds, while not having been taken up by the government surveys, has been the subject of considerable work. Doctor Snow was the first scientist in the field. He began his study of Kansas birds upon his arrival at the University in 1866, and continued his interest until dis death. . ."

In his paper on "Relation of Birds to Horticulture,"[7] Professor Snow states the food habits of various species of birds and points out their value as insect eaters. Of the English Sparrow he says: ". . . a colony . . . has been securely established at Topeka. . . . I have often been asked my opinion as to the advisability of introducing the English Sparrow into Kansas as a protection against insects . . . authorities differ widely upon this question. . . . It is claimed by Dr. Coues . . . that 'there is no occasion for these birds in this country, and that the good they do in destroying certain insects has been overrated.' Mr. Thomas Gentry, of Germantown, Pa., states that the sparrows . . . 'have become quite common in the surrounding country, and are driving away the robins [and] bluebirds . . . [the sparrows] have been of immense service in ridding our squares of the caterpillars, which were once so prevalent and so annoying. . .' Dr. Brewer says: 'We have the sparrows in great abundance in Boston, and for six years I have day after day, summer and winter, closely watched them. They never molest, attack or try to drive away any birds except their own species. . . . The bluebirds do molest and drive off the sparrows, and have been known to take possession of and keep boxes put up for and belonging to the sparrow.' Mr. Stephen Gould, of Newport, R. I., says: '. . . [the sparrow] seems to court the society of other birds, and never have the birds been so abundant on our place. . .' I may add

[5]History of the Birds of Kansas, 1891. By N. S. Goss. P. 37.
[6]Kan. Univ. Sci. Bull., Vol. VII, No. 5, June, 1913, pp. 137-158.
[7]Transactions of the Kansas State Horticultural Society, 1876, pp. 62-75.

that the report of the French parliament, based upon the most thorough scientific observations, places the English Sparrow at the head of the useful birds of France. . . . I cannot close this address without calling your attention to the great advantage which would be derived by the State if in our public schools instruction should be regularly given upon these practical subjects which are so closely related to our daily lives. Much of the time now spent by our children in the school room is wasted in the vain attempt to comprehend abstract principles of arithmetic and grammar, and in memorizing unimportant . . . details."

Professor Snow was the pioneer in Kansas ornithology. This work brought him recognition among scientific men. He attained in many fields of natural science. It was in the field of entomology that he attained not only national but international scientific recognition.

My own pioneer days on a Wisconsin farm were vividly recalled when I read of Professor Snow's efforts to save the wheat and corn fields of Kansas from the chinch-bug. We knew this pest in the '70's. Every child in the family knew and dreaded the sign of the chinch-bug. In well headed wheat fields stalks began to fall due to rust on the stem. It was the work of the chinch-bug.

Between the years 1885-1896 Professor Snow published seventeen papers on this destructive insect, four of these appearing in 1892. From a letter I received in September, 1931, from a former student of Snow I quote: "One of his more spectacular pieces of work was to destroy the chinch-bug which was taking heavy tribute from the farmers' crops. To accomplish this he found a fungus which was preying upon the bugs and proceeded to cultivate the fungus and to send it out to the farmers of stricken districts in small parcels, by mail, with instructions that they distribute the fungus where chinch-bugs were thickest. In this way he hoped that the parasite would spread and the bugs would be destroyed. For a number of years the state granted a special appropriation to carry on this work in a special laboratory in the University. Finally it was abandoned as ineffectual."

Although Professor Snow's experiment failed, it was nevertheless of far reaching and great value in awakening the farmers of the middle west to the thought that in scientific investigation lay the hope of controlling the pests of agriculture and horticulture. I recall my father saying that a professor in the Kansas University had the right idea when he studied practical things like chinch-bugs. I never knew the name of the professor until I began to write this paper.

From 1872-1907 Snow conducted twenty-six collecting expeditions mainly for insects. E. Miller says:[8] "At the present time the entomological collection contains over 21,000 species and 275,000 specimens of insects, the largest collection in the United States." L. L. Dyche, several times a member of Snow's expedition, says:[9] "In 1877 Professor Snow conducted an expedition to Wallace county, Kansas . . . the party collected about 1500 specimens of the then rare species of tiger-beetle, *Amblychyla cylindriformis*. In 1876, . . . these beetles were reported to have sold at from five to fifteen dollars for a single specimen. . ." Through exchanges with this beetle many specimens were added to the University Museum. Shortly after the death of Snow, by an act of the regents, the museum collection became The Francis Huntington Snow Entomological Collection.

Vernon L. Kellogg says:[10] "He [Snow] was the pioneer naturalist of Kansas, and for thirty years its most conspicuous representative in meteorology, botany, ornithology, and entomology. . . . His enthusiasm and energy were contagious. He made first-class men out of the best of us, and something at least worthwhile out of the worst of us. . ."

As student, teacher, friend, Snow left a deep impress. "I studied under Snow" will be a valued credential so long as an alumnus remains who can say it. Snow's college training was received from rare men. Among his teachers at Williams were Mark Hopkins and his brother Professor Albert Hopkins and that great spiritual force and interpreter of life, John Bascom. He also studied under Agassiz and came under the influence of David Starr Jordan. Men were drawn to Snow by his sincere and charming personality.

Not only to the University of Kansas but to the entire state did Francis Snow give great personal service. He was one of seventeen men to organize the Academy of Science in 1868. Five times was he elected its president. In 1885 the legislature named in his honor Snow Hall of Natural History. At the dedication Professor Snow was carried to and from the building on the shoulders of students.

J. W. Green, student of Professor Snow, says:[11] "At his home or at the home of his friend, the instructor and toiler disappeared, and we came into contact with a most genial, lovable, and companionable man. As husband, father, friend, gentleman, and scholar, his life was

[8]Kan. Acad. Sci., Vol. XXII, p. 24, 1908.
[9]Ibid., p. 24.
[10]Journal Economic Ent., Vol. 2, p. 84.
[11]Graduate Mag. Univ. Kan., Vol. VII, January, 1909, p. 128.

not only above reproach, but in him, sweetness of disposition, gentleness of manner, and consideration for others were mingled with perfect integrity."

Unspoken expression may reveal depth of feeling more fully than words. In writing Professor Snow's obituary, Vernon Kellogg says in conclusion:[12] "My personals feelings I have given no rein at all. As student, assistant, colleague and intimate friend of Francis H. Snow for twenty-five years, I have in my mind and heart such a wealth of dear memory that I do not trust myself even a word or phrase of personal appreciation. If I should, it would be too extravagant for publicity, too insufficient for my own satisfaction."

An alumnus is proud of his alma mater. Such as Francis Huntington Snow make alma mater proud of the alumnus. Snow's services made the University of Kansas and the State his debtor. His spirit has enriched the world.

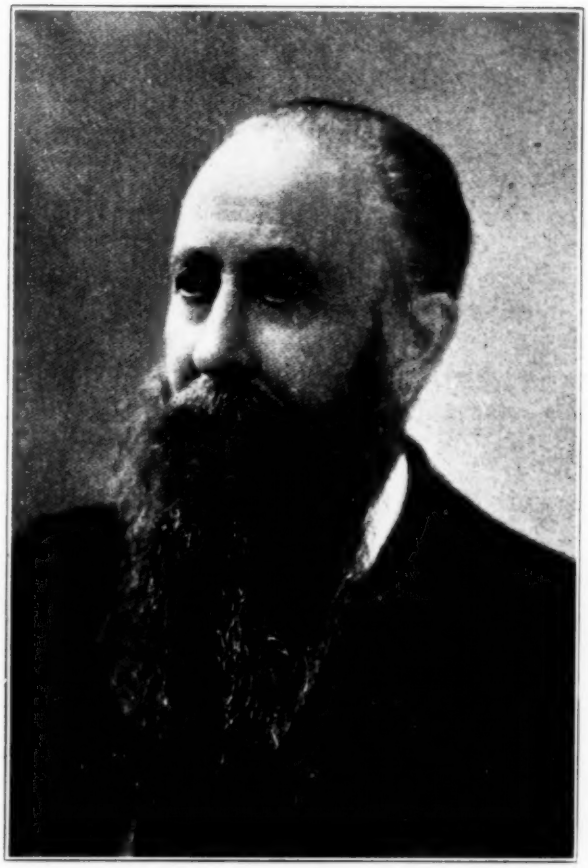
* * * *

The names of F. H. Snow and N. S. Goss are linked as pioneers in Kansas ornithology. Goss died over forty years ago. The data on his life contained in this paper are largely from files of the Topeka State Journal, issues of March 10 and 12, 1891, and a "Sketch of Goss" by Mary Jackson of which the Topeka Journal says: It is "the only authorized and authentic biography of Colonel N. S. Goss".

Nathaniel Stickney Goss, the ornithologist and naturalist, was born of Puritan stock in Lancaster, New Hampshire, June 8, 1826. He died at Neosho Falls, Kansas, March 10, 1891. He was buried in Topeka Cemetery in Kansas.

Goss was but a youth when his father lost his property and the family came west and settled in Pewaukee, Wisconsin. Here he attended the district school and the local academy. In 1854, at the age of twenty-eight years, he married Miss Emma F. Brown, of Pewaukee. Two years later he moved to Waverly, Iowa, with a view to entering the banking business. While he was making arrangements for his location, his bride of only two years died. Overcome by this loss he left Iowa in the spring of 1857. With horse and buggy he traveled to Kansas, a recently made territory, and settled on the Neosho river where now stands the city of Neosho Falls. When the little settlement was laid out for a town site Goss became its first postmaster. In 1858 a grist mill was established and he sold flour and meal to the Indians, receiving in payment Indian ponies, buffalo robes, and money.

[12]Journal Economic Ent., Vol. 2, 1909, pp. 83-85.



NATHANIEL STICKNEY GOSS, 1826-1891

Goss had taken a keen interest in the development of this new territory. He was the leader in public affairs. In 1860 he was elected and commissioned major. In 1863 he was made lieutenant-colonel of the Sixteenth Kansas Militia Cavalry. In 1867 he was appointed register of the land office at Humbolt. Two years later he resigned to become attorney for the Missouri, Kansas, and Texas Railway with headquarters at Neosho Falls. Through his efforts the road was put through Neosho Valley. In 1866 the stockholders elected him president. He was called the "Father of Neosho Valley".

The valley of the Neosho River was familiar ground to Goss. Along its banks and over the Kansas prairie he had walked noting the bird life and collecting specimens. From early childhood the deep interest of his life lay in roaming fields and forests to study life in its natural surroundings. When he had made a comfortable fortune he devoted most of his time to the study of birds and the preparation of bird skins. He traveled widely to know birds. From the Everglades of Florida he followed the western coast line to the Gulf of California. He visited the Rockies and the Sierra Nevadas. The fruit of his labors gave a marvelous collection to the State of Kansas. In the fall of 1881 he took up his residence in Topeka. In this same year he donated his entire collection to the state upon the condition that it be known as "The Goss Ornithological Collection" and that he be the custodian during his life time. The offer was accepted. The legislature set apart a room for the collection and also one for Goss's own use.*

In 1883 he published a catalogue of the birds of Kansas, based upon observations in the field and knowledge gathered during a residence of over twenty-six years in Kansas. The catalogue embraced forty-nine families and 320 species and subspecies. In 1886 he revised the catalogue, increasing the species to 335.

The American Ornithologists' Union was established in New York in 1883. "At the first congress forty-seven ornithologists were elected to active membership."[13] Colonel Goss was one of the original forty-

*The following information concerning the present condition of the Goss Collection is taken from a letter written by Mr. Kirke Mechem, Secretary of the Kansas State Historical Society, at Topeka, April 15, 1932:

"The Goss collection of birds is now housed in the museum of the Kansas State Historical Society on the fourth floor of the Memorial Building. It has been there since 1914. It is in very good condition although the birds at present need a thorough cleaning.

"The collection comprises 1523 birds of 756 species. The collection is unique in that each species of birds is mated. I understand that Col. Goss sometimes had to wait several years before he could mate some of these birds. There have been no additions to the collection since it was given to the Society."

seven members. This honor came to him unsought and without his knowledge. "Since the organization of the A. O. U. Colonel Goss has never failed to attend its meetings. . . . At the last meeting when the place of the next Congress was under discussion . . . he said . . . 'wherever it is held, Colonel Goss will be there if he is alive.' "[14]

The one ambition of his life was the completion and publication of the "History of the Birds of Kansas." This book came from the press a few days before his death. It was the summing up and completion of his life. "As a hand book or manual of the birds of a definite area, Colonel Goss's 'History of the Birds of Kansas' might in many ways serve as a model to future writers of similar works. As its title indicates, the work is strictly limited to the birds known to occur within the State of Kansas, which now number 343 species and subspecies . . . the plates are a novel feature, and, as an inexpensive method of illustration, may be regarded as a success, quite excelling in effectiveness any previous attempt at photo-engraving in ornithology we have seen. In fact, the plates are little less than a revelation respecting the possibilities of photogravure as an aid in ornithological illustration. The figures are all from mounted specimens in the 'Goss Ornithological Collection' . . ."[15]

In the preface to his "History of the Birds of Kansas", Colonel Goss says: ". . . It embraces 343 species and subspecies. . . . The photogravure illustrations represent 529 mounted birds (my own work) in 'The Goss Ornithological Collection.' The characteristic descriptions of the different orders, families, genera, species and races are chiefly from 'North American Land and Water Birds,' by Baird, Brewer and Ridgway . . . I have also quoted freely from Mr. Ridgway's 'Manual' and 'Birds of Illinois,' and occasionally from Dr. Elliott Coues' 'Key to North American Birds.' "

Goss's "History of the Birds of Kansas" is pleasant as well as instructive reading. He says of the Whistling Swan: "I have one in the 'Goss Ornithological Collection,' shot March 12th, 1875, in the Neosho valley. . . . In olden times, when credulity largely prevailed among the people, the most fabulous and absurd stories were readily believed. The Swans were supposed to sing sweetly, especially when dying. This belief seems to have been based upon the fable, that the soul of Orpheus was transmigrated into a Swan, and for this reason these birds were held in veneration. The Greek and Latin poets

[13]Bird-Lore, Vol. I, 1899, p. 147.
[14]Auk, Vol. VIII, 1891, p. 246.
[15]Auk, Vol. VIII, 1891, pp. 228-229.

praised its song, and the philosophers and historians recorded it as a fact. I quote from three of the most noted. Socrates says: 'When Swans perceive approaching death, they sing more merrily than before, because of the joy they have in going to the God they serve.' Aristotle says: 'Swans are wont to sing, particularly when about to die.' And Cicero says of Lucius Crassus, that 'He spake with the divine voice of a Swan about to die.' Pliny, one of the first to doubt, says: 'Some affirm that Swans sing lamentably a little before death, but untruly, I suppose, for experience in many has shown the contrary.'" (Page 106-107.)

Colonel Goss's friends were unnumbered, a few were intimate. Not many days after the death of General Sherman, in 1879, Colonel Goss said to Judge Humphrey: "All I wish when I am dead is that some friend will stand beside my grave and say that I have led an honest life, and have not been without good deeds or lasting friendships, for no man of whom that can be said in truth has lived in vain." The Judge replied: "I love you as a brother, and you have been my true kind friend, and if I should survive you I shall . . . say that you have not only not lived in vain but the world has been better for your existence."

Colonel Goss was not a churchman. He believed in the religion of humanity and never let an opportunity pass to do a kind act or help a fellow being in distress. When the "History of the Birds of Kansas" came from the press Goss said to Judge Humphrey: "I wish that book to be my monument. I care nothing for a shaft of stone to mark my resting place, I want to leave my monument to humanity. My work is now ended and hereafter I will play."

Colonel Goss was in splendid spirit when his book came from the press, and he went to Neosho Falls to spend a few days with his nephew, C. W. Waterman. A few days later, on the morning of March 10, 1891, the governor's office in Topeka received a dispatch from C. W. Waterman of Neosho Falls. It stated that Colonel Goss was stricken down, presumably with heart disease, while walking along the street.

After passing resolutions on the death of Colonel Goss the legislature adjourned. Upon its arrival, the body was taken directly to the senate chamber where it was placed in state in front of the president's desk. Upon the casket, surrounded by a wealth of flowers, was placed the "History of the Birds of Kansas". The room containing The Goss Ornithological Collection, as well as Colonel Goss's private room, was draped in mourning. The State House was closed on the

day of the funeral. At the service Dr. F. H. Snow, then Chancellor of the University of Kansas, spoke eloquently upon the life of Colonel Goss and the heritage he left to the state.

When Colonel Goss took up his residence in Topeka in 1881 he bought a lot in the Topeka Cemetery. The remains of his wife, which for twenty-five years had rested in Pewaukee, Wisconsin, he had had reinterred in Topeka with the expressed wish that he be laid by her side.

On March 12, 1891, the remains of Nathaniel Stickney Goss were laid to rest in the Topeka Cemetery beside those of the companion he had lost long since and loved the while.

The following paragraphs, taken from the Topeka State Journal for March 12, 1891, are self-explanatory, and are probably of sufficient interest to justify reproducing in full:

"A special from Atchison to the 'Globe-Democrat' says: Ex-State superintendent of insurance, R. B. Morris, of this city, who was a close personal friend of the late Col. N. S. Goss, of Topeka, relates an interesting circumstance of that gentleman's life in connection with the gift of his ornithological collection to the state.

"When Col. Goss gave the state the collection, he exacted a condition that the state should provide a suitable room in which to keep the collection and also a room for his own private use. This the state faithfully complied with. Soon after making the gift, Col. Goss, who was a wealthy man, made a will in which he bequeathed a large sum of money for the maintenance and increase of the collection.

"Unfortunately this was afterward changed and the item of maintenance cut out. It came about in this way: A little more than a year ago Secretary of State Higgins gave an old soldier a lunch-stand privilege in the main hall of the State House. The old soldier set up his stand in close proximity to the ornithological room, and the crowds that daily visited the collection were always loaded with edibles.

"This offended Col. Goss, and he protested against the presence of the lunch-stand, but Mr. Higgins refused to yield and the old soldier held possession. Col. Goss, who took great pride in the collection, regarded the act of Mr. Higgins as a lack of appreciation of the gift, and he at once had his friend, Railroad Commissioner Humphrey, prepare a new will omitting the bequest to the state.

"Had he not given his word that the ornithological collection should become the property of the state, this, too, would have been withdrawn. The story as here told was received by Mr. Morris from Col. Goss himself."

And at another place in the same issue occurs the following version:

"It is stated that Colonel Goss a few weeks since added a codicil to his will, in which he willed his library and a large collection of relics and curios which he had gathered on his trips to various sections, to the state university, and that he changed the provision which he had previously made, giving the state a large sum of money for the maintenance of the 'Goss Ornithological Collection', willing the amount to his nephew, C. W. Waterman, of Neosho Falls.

"He made the latter change, it is said, because the secretary of state allowed a cigar stand to be maintained in the hall of the east wing of the capitol. Colonel Goss detested tobacco and was much perturbed when the cigar stand was established there by the guide. He protested against it, and his wishes not being complied with, he considered it a personal affront."

BERKELEY, CALIFORNIA.

# NOTES FROM CENTRAL IOWA

BY PHILIP A. DUMONT

So very little has been published concerning late spring migration in central Iowa that some observations made in Polk, Dallas, Greene, Boone, and Hamilton Counties, from June 4 to 14, 1928, and from May 26 to June 21, 1929, are here submitted. Several of the field trips were taken with Mr. Arthur T. Watson and Mr. Kenneth R. Nelson of Des Moines. Mr. Walter Rosene of Ogden, and Mrs. John E. Stewart and Miss Olivia McCabe of Des Moines, were each on at least one trip with us.

In 1928 migration continued much later than usual, as is indicated by the number of birds seen on a field trip which Watson, Nelson, and I took on June 6 in Dallas, Boone, and Polk Counties. One hundred and ten species of birds were observed, including eleven species of shore birds. Of the fourteen kinds of shore birds seen during the eleven days of 1928 in Iowa, at least nine were recorded on a later date than any given for the state by Bent (Bull. U. S. Nat. Mus., 142, 1927; and 146, 1929).

On June 3, 1929, Watson, Nelson, and I spent over eighteen hours on a field trip in Dallas, Boone, and Polk Counties, and secured a list totaling 115 species. While only two species of transient shore birds were seen on this trip, during the first week of June in 1928, nine species were seen by us in the same region. Another trip taken on June 6, 1929, entirely within Polk County, resulted in a total of 101, including seven species not seen on June 3.

The summer of 1929 was characterized by an influx of Mockingbirds, by several breeding records of the Cedar Waxwing, and by the utter lack of migrating shore birds.

## The List

Holboell's Grebe. *Colymbus grisegena holboelli.* A flock of six birds carefully observed at Long Pond, seven miles west of Perry, Dallas County, on June 6, 1928. A male observed at Brenton's Slough, four miles west of Camp Dodge, Polk County, June 6, 1929. The recording of this species on such late dates is, of course, unusual. A more detailed account will be found in the September, 1929, number of the Wilson Bulletin, pp. 191-192.

Horned Grebe. *Colymbus auritus.* An adult in breeding plumage was on Little Wall Lake, three miles south of Jewell, Hamilton County, June 11, 1928.

GADWALL. *Chaulelasmus streperus.* On May 30, 1929, while at Little Wall Lake, Hamilton County, I had the unique experience of catching a Gadwall in my hands. I took it back to Des Moines with me for observation. Unfortunately it died the next morning. Evidently the bird was molting into the "eclipse" plumage, as the old primaries were quite worn and some of the new ones were already well advanced. This molting, no doubt, caused the bird's sickness and the resulting indifference to capture. In making up the skin no sign of injury could be found. The stomach was about half filled with pieces of pond-weeds and some form of small crustaceans. The specimen, a male, is now in Mr. Nelson's collection. Another bird was seen at Long Pond on June 3, 1929.

AMERICAN PINTAIL. *Dafila acuta tzitzihoa.* Members of the Des Moines Audubon Society reported a male Pintail on a small pond at East 14th Street and Euclid Avenue, Des Moines, Polk County. The bird was present all through May and was seen by the writer on June 4, 1928.

CANVAS-BACK. *Nyroca valisineria.* A pair at Little Wall Lake on June 11, 1928, and the male was seen again on the following day.

RUDDY DUCK. *Erismatura jamaicensis rubida.* One female seen in a marsh east of Jewell on May 30, 1929; one at Long Pond, June 3, 1929; and one at Brenton's Slough on June 12, 1929.

HOODED MERGANSER. *Lophodytes cucullatus.* Two females were observed at Little Wall Lake, five miles south of Jewell, Hamilton County, May 30, 1929; one female seen with a flock of Blue-winged Teal, Mallard, a Gadwall and a Ruddy Duck on Long Pond, June 3, 1929. Because of the rareness of this species as a breeder in Iowa, it is quite probable that these were late migrants. A pair of these birds were found by Miss Olivia McCabe on a small pool of water in Des Moines, June 21, 1923. This pool, surrounded by willows and cat-tails, was within fifty yards of one of the principal avenues in the city. Because of the late date and of the fact that this was apparently a mated pair, they were reported as breeding, although I am not aware that the nest was found.

AMERICAN MERGANSER. *Mergus merganser americanus.* A single female (not a cripple), seen on a small pond four miles north of Ogden, June 13, 1929. The latest spring departure date for this species recorded in Anderson's "Birds of Iowa" is May 16, in Winneshiek County.

*Anatidae.* An analysis of the ducks found in central Iowa in June, 1929, is as follows: Common Mallard, common breeder; Gadwall, late migrant; American Pintail, a pair on June 3, and a female on June 6, probably breeding, no nests found; Blue-winged Teal, most common breeder; Shoveller, two males on June 3, and one male on June 6, probably breeding, no nests found; Lesser Scaup Duck, two on June 6, three males and one female on June 12, probably either late migrants or non-breeding birds; Ruddy Duck, late migrant; Hooded Merganser, probably late migrant; American Merganser, late migrant.

Broad-winged Hawk. *Buteo platypterus platypterus.* The status of this species in Polk County has been given intensive study by several members of the Des Moines Audubon Society. A pair nesting in Crocker Woods, along the Des Moines River, have been found to be permanent residents. These birds were reported in the Bird Lore Christmas Census for 1927 and 1928. Mr. Watson has found them present during each month for two years and he furnished the data on the 1928 nesting recorded by me in the "Birds of Polk County, Iowa". About September, 1928, the female of the pair mentioned in the above account was noticed to have half of a third primary broken off and this conspicuous field mark served as a definite check on the bird's activities all winter, and until it molted the next summer.

Ferruginous Rough-leg. *Buteo regalis.* A pair of these hawks was seen at Brenton's Slough, west of Camp Dodge, on May 5, 1929, by Mr. and Mrs. John E. Stewart of Des Moines, and positively identified by us on June 6, 1929. Because of the similarity of this region to the rolling hills of western Nebraska we thought there might be a possibility of their breeding. But a search of the few trees along the stream disclosed no nest. Neither were the birds seen after that date. (See also Bull. Iowa Orn. Union, vii, 1929).

Duck Hawk. *Falco peregrinus anatum.* An immature female at Camp Mitigwa, five miles north of Woodward, Boone County, on June 6, 1928.

Ruddy Turnstone. *Arenaria interpres morinella.* A male in breeding plumage was seen at Little Wall Lake, June 11, 1928. I know of only one other occurrence of this species in central Iowa and that is of an unpublished observation by Arthur T. Watson of a single bird seen on June 5, 1926, flying up the Des Moines River near Camp Douglas, about six miles northwest of Des Moines.

Upland Plover. *Bartramia longicauda.* One juvenal, at least two weeks old, was caught to be photographed at Paton, Greene County, June 12, 1928.

Eastern Solitary Sandpiper. *Tringa solitaria solitaria.* A single bird observed at Fisher's Lake, twelve miles north of Des Moines, on June 3, 1928. Undoubtedly this was a late north-bound migrant.

Lesser Yellow-legs. *Totanus flavipes.* At Long Pond, June 6, 1928, a single bird crippled in one leg, and two birds there on June 12.

Pectoral Sandpiper. *Pisobia melanotos.* One at Little Wall Lake, June 12, 1928. Apparently a normal bird and uninjured.

White-rumped Sandpiper. *Pisobia fuscicollis.* In 1928 a flock of fifteen at Long Pond on June 6; seven at Little Wall Lake on June 11; and ten at Long Pond on June 12.

Baird's Sandpiper. *Pisobia bairdi.* Six at Long Pond on June 6, 1928, one at Little Wall Lake on June 11, 1928, and one at Long Pond on June 12. This is a later spring migration date than has been recorded by Bent for this species in the United States.

Least Sandpiper. *Pisobia minutilla.* Two at Long Pond, June 6, 1929.

Red-backed Sandpiper. *Pelidna alpina sakhalina.* Observed on both trips to Long Pond in 1928. Three on June 6 and two on June 12.

Semipalmated Sandpiper. *Ereunetes pusillus.* In 1928 one was seen at Brenton's Slough four miles west of Camp Dodge, Polk County, on June 5; ten at Long Pond, June 6; and three at the same place on June 12. Two of the three had injured legs.

Sanderling. *Crocethia alba.* A single bird still in the gray winter plumage at Long Pond on June 6, 1928. This species is also a straggler through the central part of the state.

Bonaparte's Gull. *Larus philadelphia.* A single bird was observed at Long Pond on June 6, 1928. Although found along the larger rivers and lakes of the state, it is not common at any time in the interior.

Least Tern. *Sterna antillarum antillarum.* A single bird noted flying over a small pond at East 14th Street and Euclid Avenue, Des Moines, May 27, 1929. The only Polk County record prior to 1929 for this species was of two birds seen by Kenneth R. Nelson, June 16, 1922, on the Des Moines River.

Black Tern. *Chlidonias nigra surinamensis.* Although formerly a common breeder in central Iowa, this species has been crowded out

in late years by lack of suitable nesting areas—the result of draining the marshes and small ponds. Numbers of these birds were seen in June, 1928, and a flock of thirty-five was seen June 13, 1929, north of Ogden, Boone County. However, no nests were discovered at Long Pond, a likely breeding place, seven miles west of Perry, Dallas County.

YELLOW-BILLED CUCKOO. *Coccyzus americanus americanus.*

BLACK-BILLED CUCKOO. *Coccyzus erythropthalmus.* The summer of 1929 witnessed the periodic appearance of the "17-year locust" or Periodical Cicada (*Magicicada septendecim*) in tremendous numbers, at least in central Iowa. Concurrently, large numbers of both Yellow and Black-billed Cuckoos appeared, and were found feeding on these pupae. Besides the cuckoos, the Rose-breasted Grosbeak was the only other species noted feeding on the cicada.

WESTERN BURROWING OWL. *Speotyto cunicularia hypugaea.* On May 9, 1928, a farmer living two miles northwest of Paton, Greene County, called Mr. E. W. Sells, of the same town, to report that four long-legged birds were staying around a ground hog hole in one of his fields. Mr. Sells visited the field on May 12, and saw two of the birds which he identified as Western Burrowing Owls. In writing to Mr. Walter M. Rosene, of Ogden, Mr. Sells gave him all the information and urged him to make a trip to Paton to confirm the identification. June 12, Robert Walker, Walter Rosene, Kenneth Nelson, and the writer accompanied by Mr. Sells, visited the same place and found one Western Burrowing Owl. The second bird undoubtedly was on the nest at that time as both were seen again on June 26, when Mr. Rosene spent the afternoon trying to photograph them. He succeeded in obtaining one picture. Mr. Sells saw six owls together later in the summer and concluded that four young grew to maturity. They were seen in the field until the latter part of October.

We secured about forty pellets on June 12 and several were examined by the late W. DeW. Miller, of the American Museum of Natural History, New York. These showed a large percentage of rodents while others found by Mr. Sells later in the summer consisted largely of beetles.

Dr. B. H. Bailey (Raptorial Birds of Iowa, 1918, pp. 231-233), records the Western Burrowing Owl from eight counties within the state. In five of these counties (Lyon, Sioux, Plymouth, Woodbury, and Sac), it has been reported as breeding, and in the other three (Dickinson, Kossuth, and Linn) its occurrence is only casual. Mr.

G. H. Berry's observations of this owl, made in the vicinity of Hawarden, Sioux County, and Lincoln County, South Dakota, are recorded by Anderson in his "Birds of Iowa". This record of Berry's is cited by Dr. Bailey but incorrectly credited to Linn County.

Therefore the nesting of the pair in Greene County is an extension south and east of the known breeding range of this owl.

ACADIAN FLYCATCHER. *Empidonax virescens.* In 1929 a mated pair was seen near Camp Mitigwa, five miles north of Woodward, Boone County, June 3; a nest containing four eggs was found by Messrs. Nelson and Watson in Crocker Woods, Des Moines, June 7. The nest, a loose structure made of plant-fiber and grass, was hanging in the drooping branch of a locust tree, three and a half feet above the ground. The eggs were hatched by June 20.

OLIVE-SIDED FLYCATCHER. *Nuttallornis mesoleucus.* A late migrant noted on June 10, 1928, along the Raccoon River southwest of Des Moines. The whitish tufts of feathers on either side of the rump and extending on the flanks under the wings were quite conspicuous in this individual.

*Tyrannidae.* A summary of the members of this family found in Central Iowa in June, 1929, is as follows: Eastern Kingbird, common breeder; Northern Crested Flycatcher, common breeder; Eastern Phoebe, common breeder; Acadian Flycatcher, uncommon breeder; Alder Flycatcher, rather common breeder—several nests at Des Moines; Least Flycatcher, uncommon breeder; Eastern Wood Pewee, common breeder; and Olive-sided Flycatcher, very late migrant, uncommon—one seen south of Valley Junction, June 6. The Yellow-bellied Flycatcher is a fairly common migrant in May, and the Arkansas Kingbird is a rare migrant, at least through Polk County.

NORTHERN CLIFF SWALLOW. *Petrochelidon albifrons albifrons.* One nest found by A. T. Watson, in a culvert northeast of Des Moines on June 1, 1929. Mr. Nelson and I found two pairs nesting near Moran, Dallas County, June 12, 1929. The nests were under the eaves of a corn-crib.

HOUSE WREN. *Troglodytes aedon* subsp. A male, collected at Des Moines, June 20, 1929, when compared with a series of subspecies *aedon* and *parkmani* in the American Museum of Natural History appeared to be intermediate. These intermediates are more common in central and eastern Iowa than the typical *parkmani*, and according to Mr. John T. Zimmer, a few of them have been collected in Nebraska.

Eastern Mockingbird. *Mimus polyglottos polyglottos.* One bird observed by A. T. Watson and K. R. Nelson one mile north of Polk City, Polk County, June 3, 1929. Mr. and Mrs. W. A. Kinnaird of Valley Junction reported a pair of these birds six miles south of that city on June 4, 1929. Watson, Nelson, and I saw this pair on June 6 and found their nest, which contained two eggs. Later Mr. Kinnaird reported that the nest had four eggs, all of which hatched. Another pair of mockingbirds was reported by Mr. Sibley H. Crosby in northeast Des Moines, June 7, 1929. A pair of these birds was seen by Mr. Paul Sandahl at the City Nursery in East Des Moines, June 10, 1929. Mrs. Stewart and I saw the male on June 20, but could not find the female. We believed she must be on a nest, but none could be found. Mr. Sandahl reported that they were last seen on June 26, 1929.

Willow Thrush. *Hylocichla fuscescens salicicola.* One seen in Des Moines, May 27, 1929. R. M. Anderson places this subspecies in the hypothetical list of his "Birds of Iowa", (1907). The range given for this bird in the A. O. U. Check-List is the following: "Breeds in lower Canadian and Transition zones . . . south to . . . central Iowa; . . ." Harry C. Oberholser, in a letter to me, June 15, 1929, says concerning the status of this bird in Iowa, "both might occur, get specimens; *salicicola* probably the common form. Otto Widmann (Birds of Missouri, 1907, p. 261), says of the two races in Missouri, "that both forms occur is certain . . . others (*salicicola*) have been taken in eastern as well as western Iowa . . ." It seems to me that this subspecies should have been included in Anderson's list.

Cedar Waxwing. *Bombycilla cedrorum.* While at the Ledges State Park on June 10, 1929, the Custodian, Mr. Carl Fritz Henning, informed me that a pair of Cedar Waxwings was building in a cedar in his yard. On June 16, 1929, I noticed a pair building near the top of a mulberry tree at my home in Des Moines. The nest was about twenty-eight feet from the ground and some of the material used in its construction was taken from an abandoned Robin's nest near by. A great deal of string and strips of bark were used, and building was done only in the morning. In the afternoon the pair either fed on mulberries or perched side by side close to the nest. After coming to Des Moines to attempt a photograph of this nest, Mr. Rosene found, upon returning to his home, that there was a waxwing's nest within 150 feet of his own house.

Starling. *Sturnus vulgaris vulgaris.* A pair seen in Des Moines, March 21, 1929, by Mr. and Mrs. Alexander W. Lee. This is the first

appearance of the Starling in central Iowa. (See the WILSON BULLETIN, XLI, p. 245, 1929).

TENNESSEE WARBLER. *Vermivora peregrina.* Two late records for 1928 are of single birds observed June 4, in Crocker Woods, Des Moines, and on June 6, Ledges State Park, south of Boone.

ORANGE-CROWNED WARBLER. *Vermivora celata celata.* A male collected in Des Moines, June 6, 1929. This is over three weeks later than the previous late spring record for Polk County. Its song sounded like a cross between the songs of the Tennessee and Pine Warblers—a soft trill ending with an ascending note. The specimen is now in Mr. Nelson's collection.

GRINNELL'S WATER-THRUSH. *Seiurus noveboracensis notabilis.* A single bird observed at Long Pond on June 6, 1928, apparently a late migrant, as the only typical breeding grounds of this species was several miles away. In 1929 a pair of these birds was seen at Camp Mitigwa, north of Woodward, June 13. As both birds were carrying food we suspected that they had young in a nearby nest.

MOURNING WARBLER. *Oporornis philadelphia.* A male seen at Camp Mitigwa on June 13, 1929. There was no proof that this bird was anything other than a late migrant.

EASTERN SAVANNAH SPARROW. *Passerculus sandwichensis savanna.* A juvenal, probably out of the nest at least ten days, was observed with one adult along the west side of Little Wall Lake on June 12, 1928.

NELSON'S SPARROW. *Ammospiza caudacuta nelsoni.* One bird was noted at Long Pond and another at a small pond two miles south on June 12, 1928. It seemed likely that birds present at that date were breeding but no nests were found. A single bird flushed from the edge of the marsh at East 14th Street and Euclid Avenue, Des Moines, May 27, 1929.

MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA,
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# THE WILSON BULLETIN

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## EDITORIAL

### The Annual Meeting at Columbus

The next annual meeting of the Club will be held at Columbus, Ohio, on the three days following Thanksgiving Day. The program and business sessions will occupy Friday and Saturday, November 25-26; and on Sunday a visit will be made to Buckeye Lake, which is an interesting inland body of water, about thirty square miles in extent. In the vicinity of this lake 285 species of birds have been recorded.

The sessions will be held in the splendid auditorium of the Ohio State Museum on the Ohio State University campus. Mr. E. S. Thomas, Curator of Natural History, will act as guide to the numerous exhibits of interest to ornithologists. (The Editor especially recommends that visitors be sure to see the extensive collection of Indian effigy pipes, carved in imitation of many species of birds). Plans are being made to have a display of paintings and photographs by members, and those who desire to participate are invited to communicate with the Secretary.

The large membership in Ohio and adjoining states is an assurance that the meeting this year will be well attended, notwithstanding adverse general conditions. It is expected that the total registration will not fall much below that of other recent meetings.

There will not be another issue of the Bulletin prior to the meeting, but the Secretary's annual letter will give details concerning the program, hotel headquarters, etc. The officers are now at work on the program, and we urge our members to make an early report to the Secretary concerning any contribution to the program. Papers of all types are desired, and especially those illustrated with slides or movies of general interest.

In order to extend our usefulness as well as to keep up our finances we are anxious to enlarge our membership. To this end every member is requested to recommend to the Secretary at least one prospective member. This is the most effective means of developing the organization, and we do not believe that our resources are by any means yet exhausted.

One of the Pleasures in bird study is the general fact that every day of field work brings some new bit of information to the observer's experience. The truth of that will be well known to every field worker. Very few would wish to deny that experience of growth. We live in constant hope and expectation that we will have the same experience of discovery and growth tomorrow, and the day after, throughout all the future. This could not be so if it were possible for us to gather all knowledge within any limited period of time. It has been the invariable human experience in the past that individual mental development, as well as collective human knowledge, has been gradual and cumulative. Upon the basis of this experience we entertain a hope and prediction for the future. How vain is, therefore, the mortal who holds himself in conceit, and looks with disdain or condescension upon his fellow-worker.

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Literary Contributions are so necessary to the maintenance of the Bulletin that any thought of offering general criticism of authors' technique may well be questioned. However, it is with the spirit of mutual helpfulness that the Editor ventures to make a few suggestions. No matter how experienced and skilful a writer may be his manuscript is almost sure to require some editing to bring it into conformity with the style of the magazine to which it is submitted. Many authors study the style of the magazine in which they expect to publish. Doubtless different authors use all degrees of care in preparing a paper for publication. It was our thought to suggest that a manuscript should not be submitted for publication until it had been revised at least three times; once for elimination and condensation; again for clearness. Then the second revision should be read three times, once for syntax, once for capitalization and spelling, and once for punctuation. It may now be revised to include these corrections. There is little doubt that many scientific papers are revised a dozen times or more before publication. Then the author may typewrite it, double-spaced, on good paper (not thin, flimsy stuff), and send the original (not the carbon copy) to the Editor.

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During Mr. Ridgway's Life he succeeded in issuing the volumes of "The Birds of North and Middle America" about every three years on the average, until eight volumes had been published. Mr. Ridgway had completed his work on the ninth volume three or four years before his death; so, this work has been allowed to remain unpublished for perhaps seven years. We hope it is not the intention to abandon this publication entirely. The set should be completed. There is no work so complete in the treatment of distribution and synonomy, and it is essential for reference in these matters. In the interest of scientific convenience it should be carried on to completion.

## GENERAL NOTES

**Conducted by M. H. Swenk**

**A Late Date for the Chimney Swift in Indiana.**—Last fall (1931) during a warm spell, we saw a pair of Chimney Swifts (*Chaetura pelagica*) fluttering in the air one Sunday afternoon, and the date was November 20. That was the latest record I have ever known these birds to be seen in this part of the country.—Mrs. Horace P. Cook, *Anderson, Ind.*

**Two Iowa Duck Records.**—On November 15, 1928, Dr. E. M. MacEwen shot a duck near Lone Tree, Iowa, that was identified as a cross between a Mallard and a Pintail. The duck was sent to W. T. Hornaday, who verified the identification. It is now on display at the University of Iowa.

In the fall of 1931 a duck was shot by a Mr. Wendell of Estherville, Iowa, which was probably a Fulvous Tree Duck (*Dendrocygna fulva*). The duck was taken to F. P. Hopkins of Spirit Lake. While Mr. Hopkins is not an ornithologist he is a very careful amateur ichthyologist and understands the importance of care in identifying unusual species. He said that the duck was shot from a tree. Its legs were about twice as long as those of a teal and blue-black in color. Its bill was short, dark and somewhat broad. The rest of the description also fitted the Fulvous Tree Duck exactly. Unfortunately the duck was not saved. I believe that this bird should be included in future state lists as a hypothetical record.—F. L. R. Roberts, *Iowa City, Iowa.*

**Great Horned Owls Dying in the Wild from Diseases.**—On February 21, 1932, in the course of some raptor studies east of Prairie du Sac, Wisconsin, a nesting Great Horned Owl (feathers plucked from underparts) was found freshly dead and intact beneath a favorite roost tree. It lay with ventral surface on the ground, wings partially spread and talons about half closed. Careful examination preceded by plucking proved that the bird was in full flesh and bore no external injuries of any sort. Hippoboscid (blood sucking) flies off the carcass were conspicuous and active. The most recent pellet was smaller than the usual size, and, judging by the mucus, probably less than forty-eight hours old.

This owl was sent to Dr. R. G. Green, Univeristy of Minnesota bacteriologist, who has been making a specialty of wild life diseases. He reported in a letter: "The liver was normal in size, showed some congestion and numerous fine necrotic areas. The spleen was greatly enlarged and thickly packed with small discrete abscesses of varying size. All other organs appeared normal." A captive Great Horned Owl and a Screech Owl succumbed to inoculation with infective material. A captive Barred Owl, likewise inoculated, seemed immune. Dr. Green told me orally that the disease was not tularemia (to which none of his experimental raptors have as yet shown susceptibility), and that the evidence indicates a virus, possibly specific for certain owls. He will publish elsewhere the technical data from his investigation.

Unfortunately, I did not again visit the owl territory until April 6, when the remains of the second Great Horned Owl—the mate of the first—were discovered, also under one of the habitually used roost trees. Only the wings and a picked and bleached sternum could be located, so the specimen cannot be said to have had more than limited diagnostic value. At any rate, both members of the pair were then accounted for; both apparently dead within a short time of each other, presumably victims of the same contagion.—Paul L. Errington, *Madison, Wis.*

**Recent Changes in South Dakota Bird Life.**—Many South Dakota lakes are rather low at this time (1931), due to the dry summer of 1930. Other lakes are entirely dry and the effect on bird life is very noticeable. Lake Albert, in Kingsbury County, was formerly the home of a large colony of Double-crested Cormorants, but at present the lake is a huge flax field. The cormorant colony on Dry Lake, north of Lake Albert, is also gone, probably due to molestation. The remnants of the two colonies just mentioned selected a rocky island in nearby Lake Poinsett, and here several hundred birds are nesting. A fine colony of Western Grebes was, however, found on Dry Lake.

Roy Lake, northeast of the Waubay Lakes, was once the site of a fair-sized cormorant colony, but fishermen decided the birds were too fond of fish, and the colony was shot out during 1930. The remnants of this colony has evidently settled on Cattail Lake, near old Fort Sisseton, and has easily doubled the size of the old colony at this place.

The fine cormorant colony on South Waubay Lake is probably the largest colony left in the United States. This season Mr. Arthur Lundquist, of Webster, South Dakota, and the writer found nearly 700 nests on the two islands. The Ring-billed Gulls on the larger island seemed to be back in larger numbers, and several hundred nesting birds were seen. The large colony of Common Terns has, however, almost deserted this island, and less than a dozen pairs were there nesting this year (1931).

In general the water and shore birds are decreasing in this area. Duck nests were less numerous than usual this year. Holboell's and Eared Grebes seemed less numerous than in other years. Western Grebes appeared more abundant on Rush Lake, but this was no doubt due to the fact, that this species was not nesting on South Waubay Lake, or on other lakes and sloughs where it had formerly nested. The Western Grebes chose Rush Lake for a breeding ground this year and it appears that most of the grebes of this region have come to the above lake this summer.

Western Willets and Upland Plovers were not seen in the usual numbers, but the Marbled Godwit was apparently present in about its usual numbers. Clay-colored Sparrows were found nesting in several likely places. The Prairie Marsh Wren and the Short-billed Marsh Wren were seen in many marshy areas, the former being much the more common. A male Nelson's Sparrow, in breeding condition, was taken at Rush Lake, on June 7, 1931.—William Youngworth, *Sioux City, Iowa.*

**Woodcocks and Wood Ducks in Washington County, Iowa.**—While patroling on Skunk River on July 14, 1932, my spaniel flushed a Woodcock within fifteen or twenty yards of me, and another not over that far from the first one. They flew not over fifty yards and lit near each other. I called the dog in because they acted as if they had young there, and backed up for fear the dog would catch their young. It was in large elm timber on low, wet bottom ground and with some heavy cover, near the county line between Washington and Keokuk Counties, Iowa.

I am a great lover of the woods and of all birds, have a good dog, and get great pleasure in walking along the creeks and rivers. However, this was the first time in fifty-one years here that I have seen a pair of Woodcocks at that time of the year. I can find some in October every year, on the bottom, in moist low

places, and I actually believe there are more coming through here in the fall now than there were years ago.

There are not as many Wood Ducks hatching here as there used to be, but there are some remaining about the Pinoak Ponds whenever we have water to keep the ponds full. Last fall on the Conesville marsh the week before the twentieth of October, the open season, I estimated there were from 400 to 500 Wood Ducks on the upper part of the marsh, and I personally told all the club members there to be careful not to shoot any of them. Only a few of the old hunters know them by their flight any more.—E. L. Breitenbach, *Washington, Iowa.*

**The Swallow-tailed Kite in Pottawattamie County, Iowa.**—It has now been about two decades since the Northern Swallow-tailed Kite (*Elanoides forficatus forficatus*) has been reported from Iowa. Early in July of 1931 a farmer shot one of these birds along the West Nishnabotna River, a few miles southwest of Oakland, Pottawattamie County, Iowa, and brought it to Mr. Leo Lockhart, of Hancock (a few miles north of Oakland), for mounting. The bird was, however, subsequently sent to the shop of Karl Schwarz, the taxidermist at 419 South 13th Street, Omaha, Nebraska, who mounted it. I first learned of its presence in his shop on July 8, and some time later secured the specimen from Mr. Lockhart, and it is now in my collection. It is a good specimen, and from its size I should judge was a male, the measurements of the mounted bird being in millimeters as follows: Length, 556; wing, 400; tail, 263 (unusually short); tarsus, 30; exposed culmen, 20.5 (from feathers, 27); depth of bill at base, 13.5.—Myron H. Swenk, *Lincoln, Nebr.*

**An Experiment with Nesting Purple Grackles.**—A great many Purple Grackles (*Quisculus q. quiscula*) nest in the neighborhood of my yard at Lexington, Virginia. While taking a set of eggs during the spring of 1928, it occurred to me to try the experiment of changing eggs from one nest to another to see if a Purple Grackle would hatch eggs that were not her own. I took six eggs from a nest and replaced them with five eggs from another nest. The bird to which I gave the five new eggs had begun, I think, to incubate her original eggs. One factor that made me more doubtful as to whether my experiment would succeed was that I had kept the five eggs overnight before I decided to try the exchange. I did not, however, remove the original six eggs until I was ready to replace them with the five new ones. The exchange was made early in the afternoon of April 26. Later in the afternoon the bird was on the new set of eggs. She did not lay another egg to bring the number up to that of her original set of six. On May 7 she was still incubating normally. When I returned home on May 12, after an absence of four days, I found that she had hatched out the foster set. The nestlings appeared to be about three days old. The younger birds all lived to leave the nest. The adults, both male and female, were much excited each time that I visited the nest and at times alighted near me in the small tree, with much scolding, but the fact that they reared their young in spite of this exchange of eggs and of my frequent visits seems to show that Purple Grackles are not very sensitive as to nesting conditions.—J. J. Murray, *Lexington, Va.*

**Cedar Waxwings Feeding on Ash Flower Stamens.**—Approximately forty Cedar Waxwings (*Ampelis cedrorum*) have been stopping for at least the past two days (April 11 and 12) in several rows of ash trees lining a boulevard in the south part of Kansas City. The trees are bare of leaves but the staminate flowers are just beginning to shed their pollen. The waxwings are gorging on the mature stamens. They perch among the branches of the comparatively small trees and pay little attention to passersby, whether they be on foot or in motor cars. Occasionally they reach out for another beak full of flower stamens. Three weeks ago waxwings were seen in the neighborhood, feeding on small rotted apples still hanging on the trees.—A. E. Shirling, *Kansas City, Mo.*

**A New York Ring-necked Pheasant Census.**—On April 25, 1930, while traveling from Geneva to Rochester, New York, a count was made of the number of Ring-necked Pheasants occurring within a defined area extending parallel to the Lehigh Railroad. On April 30, another count was made over the same territory, while traveling from Rochester back to Geneva. Conditions for observation were excellent, since at that season of the year there were no crops or leaves on the trees to in any way obstruct the view. The birds were very tame, seemingly, and continued to feed and move about in the fields, very little affected by the presence of the passing train. An attempt was made to count all birds within the limits of one-tenth of a mile on one side of the passing train, from a window of which these notes were recorded. A record was kept of the nature of the groupings of the birds, in order if possible to apprehend any dearth in the number of breeding males as compared to the total estimated population.

Between Geneva and Rochester a total of fifty birds were counted. Of these twenty-two were male birds. The following groupings were recorded: Eleven males were each alone; four males were each accompanied by one hen; five males were each accompanied by two hens; one male was accompanied by four hens; one male was accompanied by six hens; four hens were each alone.

Between Rochester and Geneva a total of fifty-one birds were counted, of which twenty-six were males. They were distributed in groups as follows: Thirteen males were each alone; four males were each accompanied by one hen; two males were each accompanied by two hens; two males were each accompanied by three hens; one male was accompanied by five hens; four males were fighting (two different sets); two hens were each alone; three hens were in one flock.

The total distance between Geneva and Rochester is 40.6 miles. Observations were limited as nearly as possible to an area one-tenth of a mile wide. Thus, for a total area of 4.06 square miles, these figures show an approximate pheasant population of thirteen birds per square mile.

Regarding the number of males, twenty-two were counted on the first trip, and twenty-six on the second. If twenty-four were taken as the average number, there would be approximately six breeding males per square mile. While it is comparatively easy to overlook an occasional female in making such a count, I believe that the number of males counted represents a fairly accurate account of the number existing over that area at that time. Nowhere in the state have I seen the Ring-necked Pheasant as numerous, although there are few areas over which it would be so easy to count the birds as in the flat agricultural region about Rochester.—R. G. Johnson, *Oneonta, N. Y.*

**Double and Triple Nests of the Red-winged Blackbird.**—This prairie town has no water near except the artificial lake for the city water supply. On the banks of this lake I find colonies of the Red-winged Blackbird. The first of these nests I find very low, and band the young about the first of May, but as the season advances I find the nests higher, several of them placed in willows or mesquite at a height of eight or ten feet. The last banding this season (1931) was on July 12. In the cattails I found several two-story nests and one of three stories (see illustration). Each nest was perfect, and I banded nestlings from the last two.—Mrs. Jack Hagar, *Corsicana, Tex.*

**The Chipmunk as an Enemy of Birds.**—We all know that birds have many enemies. However, I thought that I was aware of most of them, and liking birds on the whole better than I do their persecutors, I have always aided the birds as much as possible. But I was a bit surprised on May 8, 1929, when I was forced to catalog a new enemy of bird life, a creature that until that time I had considered free of guilt as far as taking the life of a bird was concerned.

My patch of Cumberland raspberries is situated less than a stone's throw east of the house, and being properly pruned each season, the bushes afforded several species of bramble-loving birds splendid nesting sites each spring. Some time prior to the date mentioned, a pair of Cardinals (*Richmondena cardinalis*) had selected a clump of raspberries that suited them, and had built a nest in it.

I watched the nest closely from the beginning, knew when the first egg was laid, saw them through the period of incubation, and, at last, saw the nest filled almost to overflowing with three hungry young Cardinals. They were large, so heavy that the insecurely fastened nest tilted to one side, when the tragedy occurred, early in the morning. I heard the clamor of the parent birds and rushed down. The nest still contained one bird, another on the ground was injured, but living, and the whereabouts of the third was shown me by the actions of the female Cardinal. A fence with one-inch mesh surrounded the raspberry patch, and I saw her, fluttering and crying frantically, apparently trying to rush through the fence head foremost. She flew away when I arrived but mother love asserted itself shortly, and she was back, hovering near me, crying piteously as I extricated from the mesh of the fence all that remained of the lifeless young Cardinal. But I had seen the culprit! That black-striped back gave him away as he, noting my approach, ceased struggling in the attempt to pull a too large young Cardinal through the fence, and hurried back to his old home in the brush pile below the path. The enemy was a Chipmunk, a fellow that I had considered neutral, if I did not call him a friend. Nature had taught me something more. His home was destroyed and later he went the way of many

other enemies of my birds. Chipmunks have been added to the black list now.

I righted the nest of the Cardinals and replaced the injured young one, but it did not live. However, the parent birds did not desert the sole survivor of the tragedy. A few mornings later they had induced him to try his wings, and I saw the solitary youngster, shortly after sunup, sitting on a post beside the path that leads into the hollow.—GRANT HENDERSON, *Greensburg, Ind.*

**The Great Blue Heron Flops on Its Prey.**—Late one afternoon we sat in an automobile south of Lake George, New York, and had an excellent opportunity of watching the fishing movements of a Great Blue Heron (*Ardea herodias herodias*) in a small stream about sixty feet away. The heron walked very stealthily in the water beside some reeds, and was in full view. The water was about three inches deep there. As each foot was raised from the water the toes hung vertically and limp; then were flattened out before touching the surface in the forward step. The heron held its head quietly, except with a forward swing with each step, and with the bill at an angle of about forty-five degrees. Suddenly it seemed to drop upon its prey. In this act it bent its knees and ankles together to bring the force of its weight into the thrust. Its action was not entirely a neck motion, with the body revolving or tilting on the fulcrum of the hip joint, but was a whole dropping of the body. Its entire head was immersed. When it came up it had a fish at least six inches long. It appeared to have thrust its bill, or one blade at least, through the fish. The heron carried the struggling fish to shallower water and appeared to stab it two or three times. Then juggling it into the right position, it was swallowed head first, and the bird resumed its fishing. The lump in the throat was seen to go down. A few minutes later the Heron caught a minnow in the same manner.—HAROLD B. WOOD, *Harrisburg, Pa.*

**The Blue-gray Gnatcatcher Moves Its Nest.**—Much has been published lately in the WILSON BULLETIN in regard to the nesting of the Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*). On May 15, 1932, I observed the nest of a Blue-gray Gnatcatcher in a small elm tree twenty-two feet from the ground. The male and female were both seen. The same day, and about 200 yards from the gnatcatcher's nest, I found the nest of a Green Heron (*Butorides virescens virescens*) the female being on the nest.

One week later, on May 22, 1932, I again visited this locality. The Green Heron's nest was gone, having been robbed and the nest thrown to the ground. These birds then built another nest in the same tree that contained the gnatcatcher's nest and about twelve feet from it. While looking for the latter nest, one of the gnatcatchers suddenly appeared and flew to the spot where the nest originally had been. Gathering a piece of nesting material in its bill it flew away, but in a short time returned. The nest at this time was almost gone, only the bottom part of it remaining.

That they do remove their nests to other situations is almost certain, as in this case the Green Heron having built close to the gnatcatcher's nest, made them change their location. Another thing I have observed about these birds, is that they generally build their nests from ten days to two weeks before laying their eggs. This I think is due to the fact that they nest early (in this locality) and do not deposit eggs until the trees are well leafed out.—C. K. LLOYD, *Oxford, Ohio.*

**Some Corrections and Additions to the New A. O. U. Check-List.**—The following are some corrections and additions to the recent (1931) fourth edition of the A. O. U. Check-List:

Page 25. Man-o'-war-bird. (*Fregata magnificens*). Breeds on different keys in Monroe County in different years, and has for over ten years to my knowledge, on Bird Key, outside of the railway trestle, in 1931.

Page 31. American Bittern (*Botaurus lentiginosus*). Breeds in Dade County, southern Florida.

Page 67. Insular Red-shouldered Hawk (*Buteo lineatus extimus*). The range as given, Florida Keys, is very inaccurate, for it breeds only sparingly on the keys, and commonly on the mainland, as far northward as a line across the state from Palm Beach to Fort Myers. Above that line, breeding birds are nearer *B. l. alleni* than *extimus*.

Page 68. Swainson's Hawk (*Buteo swainsoni*). Florida range, given as "casual", should be changed to "a regular migrant".

Page 72. Marsh Hawk (*Circus hudsonius*). This bird breeds sparingly in Dade County, southern Florida.

Page 77. Little Sparrow Hawk (*Falco sparverius paulus*). True typical *paulus* breeds in Florida only north to a line across the state north of Lake Okeechobee; above that it intergrades with *F. s. sparverius*.

Page 101. Mexican Jacana (*Jacana spinosa gymnostoma*). The Check-List questions the subspecific identity of C. B. Cory's record of this bird. My father, the late H. B. Bailey, recorded a Jacana seen on his trip, by skiff, from Kissimee to Fort Myers, in March, 1911. (See "Birds of Florida", page 59). Any field identification given by him, especially of such a bird as this, can be relied upon, for few men had his faculty for identifying birds correctly in the field, and his notes were never questioned.

Page 114. Spotted Sandpiper (*Actitis macularia*). This species should have been given as breeding in Florida, where I have taken the downy young. ("Birds of Florida", page 54).

Page 134. Franklin's Gull (*Larus pipixcan*). Winters from Florida Bay and the Gulf Coast of Florida southward.

Page 151. White-crowned Pigeon (*Columba leucocephala*). This pigeon has been a regular breeder on several of the smaller keys in Florida Bay for many years, and also on main Key Largo (1930-31), it is a regular winter resident on the mainland in Monroe County, where it comes for the hardwood native berries and food similar to that which is to be found on the keys.

Page 152. Scaled Pigeon (*Columba squamosa*). The two records as given from Key West, were undoubtedly escaped caged birds brought over from Cuba by the tobacco workers, as were several other varieties of Cuban doves.

Page 154. Ringed Turtle Dove (*Streptopelia risoria*). This dove is a common breeder also at Miami Beach and some of the islands in Biscayne Bay, and a few breed at Miami proper, since I recorded it in the *Oologist*, page 91, volume 29, 1922.

Page 157. The Key West, Ruddy, and Blue-headed Quail Doves, as recorded from Florida, were undoubtedly all escaped caged birds brought over from Cuba by the tobacco workers living and working at Key West. I have had many of each variety in captivity the past few years, and have secured many more for friends, hoping to breed them before they become exterminated. The wing

structure of these varieties, and their habits as well, dispel all chance of their having migrated or been blown into Florida by a tropical storm.

Page 160. Black-billed Cuckoo (*Coccyzus erythropthalmus*). Breeds south of the Georgia-Florida line, north of Gainesville and Lake City, where I have seen young and old the first week in July.

Page 206. Eastern Phoebe (*Sayornis phoebe*). Breeds south in Florida to below Lake City, where I have found young in the nest in July, in the usual manner, under bridges.

Page 223. Florida Jay (*Aphelocoma coerulescens*). The range of this bird, as given, is misleading, for it is not found on the peninsula of Florida below scrub oak territory, which is Lemon City (northern part of Miami City) on the East Coast, and the peninsula extends over a hundred miles farther south and is commonly known as Tropical Florida.

Page 229. Black-capped Chickadee (*Penthestes atricapillus atricapillus*). The range as given (Alleghanies south to North Carolina) is erroneous. Breeding birds taken at Mountain Lake, Giles County, Virginia (altitude 4000 feet) on May 28, 1913, and submitted to Dr. Witmer Stone for identification, were identified as, and are, *P. carolinensis carolinensis*. (See "Birds of Virginia", page 344). Evidently this has been overlooked by Dr. Stone, or slipped his memory.

Page 251. Catbird (*Dumetella carolinensis*). Northern Florida, as given, is not correct, for they breed southward to Fort Lauderdale, and since my "Birds of Florida" (1925) book came out, I have found a single pair breeding as far south as Cape Sable, Monroe County, in 1926.

Page 252. Brown Thrasher (*Toxostoma rufum*). This bird breeds sparingly to Cutler, Dade County, and in one case at Cape Sable, Monroe County, in 1926.

Page 274. Key West Vireo (*Vireo griseus maynardi*). This vireo breeds in Dade County northward at least as far as the Tamiami Trail, resorting to the hardwood hammocks, similar to the foliage of the keys farther south .

Page 292. Collins's Warbler (*Dendroica discolor collinsi*). The vernacular name given this bird was "Collins's Warbler" not "Florida Prairie Warbler", as given in the Check-List.

Page 294. Kentucky Warbler (*Oporornis formosus*). Breeds in northern and northwestern Florida, sparingly.

Page 303. Red-winged Blackbirds (*Agelaius* subspp.). There is still a great deal of work to be done with the several subspecies found in the state of Florida. I do not agree with the ranges or races of several Florida birds, as given in the Check-List.

Page 307. Baltimore Oriole (*Icterus galbula*). This bird breeds sparingly in northern Florida, between Lake City and the Georgia line, where nests with young have been noted.

Page 309. Eastern Cowbird (*Molothrus ater ater*). Breeds as far south as Cape Sable, Monroe County, where I have taken one record.

Page 326. Pine Siskin (*Spinus pinus pinus*). This range as given is misleading, for while I resided at San Francisco, California, 1902-05, many sets of eggs were taken with birds by several collectors, from an area bordering San Francisco Bay, adjacent to, and little above tidewater.

Page 339. Shannon's Seaside Sparrow (*Ammospiza maritima shannoni*). This new race from the seacoast of northeast Florida changes the range as given

for *A. m. macgillivraii.* (Bulletin No. 7, Bailey Museum of Natural History, August, 1931).

Page 363. Snow Bunting (*Plectrophenax nivalis*). The C. B. Cory record of this bird in Florida is of doubtful value, and should not have been used, unless in the Florida hypothetical list. This record was gone into thoroughly by the writer when working on the "Birds of Florida", and after all facts were known, it was thought best to eliminate it.—HAROLD H. BAILEY, *Miami, Florida.*

**The Nesting Behavior of a Pair of Mockingbirds.**—The Mockingbird (*Mimus polyglottos polyglottos*) is locally an abundant migrant and fairly common summer resident, while a few males winter here. An increase in recent years in the number of migrants would indicate a northward extension of the species. One male individual that winters here is recognizable by his song, for he is a master artist in his imitations of other birds. Throughout the year at no time does he wander more than within a radius of a half mile. In the winter he skulks shyly through the bare trees in a weird manner, and at sight of another bird gives his warning note, which is the only one used throughout the winter.

On February 22, 1929, he commenced crooning, and this was kept up until the first week in March when his ecstatic joy was shown by his impassioned outbursts of song. About this time he began to investigate nesting sites. He devoted most of his time inspecting a neighbor's climbing rosebush. After the arrival of his mate, on April 3, they both continued the search, but did not come to a decision until the latter part of April, when they chose to place their home very near the street, in a rosebush in my own yard.

The nest was placed three feet from the ground. They did not notice the traffic while building, but while nesting the sitting bird flew off every time a vehicle passed. On April 28, a dark, cloudy day, I noticed the pair picking up twig ends of a last year's locust in the yard. These twig ends were about four inches long and were carried far back in the bill at about the middle of the twig. They flew first to the fence about a foot from the nest, and then to the nest, putting the twigs in place. Both seemed to be taking the same interest in building.

When first observed the nest was fairly well started. The nest was completed by April 30 and apparently was then deserted. The outer layer was composed entirely of the locust twigs, the inner layer was of small rootlets, and between these was a thin layer of moss. This mossy layer is in every Mockingbird's nest that I have ever examined in this vicinity.

But they returned on May 4. On May 5, 6, and 7 an egg was deposited each day. The squirrels kept bothering them, and finally destroyed two of the eggs. On May 15 the nest was deserted and on the same day another one was commenced in the neighbor's climbing rose. This nest was placed seven feet from the ground. The usual height in this vicinity is three feet.

When the female commenced incubation the male chose a walnut tree 350 feet away for a perching and singing tree. He stayed most of the time in the tree, skulking through its branches and frequently roaming through the neighborhood. When the eggs were hatched he commenced his irrepressible singing, keeping it up most of the day and for several hours at night. The song of day was mellowed by the heat and other noises into a fascinating silvery melody, while in the quiet hours of the night the bold, clear notes were strikingly intensified.

The young left the nest on June 19. They were joined by the male, and for three or four days the family stayed in the yard. They then left for a vacant lot, where they remained for three or four weeks. Then the female abandoned them, to return to her old nest and raise another family. The same family routine was repeated as in the first, until the brood left on August 18. The male again joined his family in the yard and then to the vacant lot, where they remained together until migration.—KATIE M. ROADS, *Hillsboro, Ohio.*

**The Re-use of Nest Material.**—Mr. John B. Lewis, in the June issue of the WILSON BULLETIN, notes the disappearance of Blue-gray Gnatcatchers' and Ruby-throated Hummingbirds' nests after the young had left and his observations suggest the re-use of the material either by the original builder or another bird of the same species. Another cause for the disappearance of such nests may be suggested by the occurrence in two instances of an old Wood Pewee's nest as an interior ornament of a Red-shouldered Hawk's nest. Description of a nest found in Jefferson Township, Cook County, Illinois, April 16, 1893, mentions this detail, and that of another found in Northfield Township, in the same county, April 10, 1898, also notes it. Perhaps an old lichen-covered nest attracts hawks as snake-skins do Crested Flycatchers. Incidentally, the circumstance that I have found onion skins and bits of waxed paper in the nests of the latter species, prompts the thought that it is not because it is a snake-skin but because of its glitter that the object is picked up.—EDWARD R. FORD, *Chicago, Ill.*

**An Encounter Between a Cooper's Hawk and a Horned Owl.**—On July 7, 1931, I was visiting a juvenile Great Horned Owl that had previously been tethered on the ground for a study of its food habits in a woodlot west of Pine Bluff, Wisconsin. The adult owl that was taking care of the youngster appeared at my approach, alighted in a tree near by, and started the usual hostile demonstration of hooting and bill snapping. As if in answer to the hoots, the cry of a Cooper's Hawk came from deeper in the woods, and an instant later a female hawk dashed at the adult owl with terrific speed. Like a skilled boxer, the owl ducked, barely evading the hawk's talons. Several times in very short order the owl had to dodge as the raging hawk struck from all sides.

During the first part of this performance, the owl had been nearly as much concerned on account of my proximity to the juvenile as it had been with the attacks of the Cooper's Hawk. Finally, things became sufficiently hot that the owl left the branch upon which it had perched, and launched forth in direct and purposeful chase of the Cooper's Hawk, which kept just ahead of her larger pursuer for several yards before doubling back, to wheel and strike again. The hawk behaved as though utterly maddened, but she never let herself get quite within reach of the owl's talons. Her safety was plainly dependent upon her superior agility and precision of movement. For a brief space the action became so fast that I could not see exactly what was happening, especially at close quarters when it seemed that neither bird could avoid being hit. However, it is improbable that damage was done, for not even a feather was noted to fall. The hawk soon went her way, cackling as she flew, and the owl was free once more to center upon me its earnest attention. The hawk gave no evidence of having seen me.

A search of a few minutes revealed the hawk's nest 110 yards away. Two juveniles, ready to fly, were perched on the rim.—PAUL L. ERRINGTON, *Ames, Iowa.*

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| 300 | 2.75 | 3.50 | 5.00 | 6.25 | 7.50 | 8.75 | 10.00 | 11.25 | 12.50 | 13.75 | 15.00 | 4.00 |
| 400 | 3.25 | 4.00 | 5.50 | 6.75 | 8.00 | 9.25 | 10.50 | 11.75 | 13.00 | 14.25 | 15.50 | 5.00 |
| 500 | 3.75 | 4.50 | 6.00 | 7.25 | 8.50 | 9.75 | 11.00 | 12.25 | 13.50 | 14.75 | 16.00 | 6.00 |

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"Every mill and farm is a memorial without inscription to the birds long forgotten except in the annals of science. Ignorance reads not, knows not God, sees in a bird a mere bit of animated clay to be shot in gratification of the lingering instincts of the brute and the savage. . . . The great Audubon fell on his knees in the forest where the Wood Thrush sang. The ignorant Spanish Catholic convert dropped his oars on the Amazon and crossed his breast in fear, as the Bell Bird of the South American forests sent out its bell-notes to flood the listening earth; and in fair Northland constrained the soul that has parted with a little of its animality, to drop a tear as the White-throated Sparrow drops the curtain of the night with signal notes of soulful tenderness, or the Black-cap welcomes the rising sun with a crystal note of infinite sweetness and pathos. . . .

"To be able to read and interpret the Great Book of Nature is worth infinitely more than to be able to read the languages of other times and peoples. Blessed is the man who, having got his eyes and ears open to the wonders of the earth and sky, walks daily amid things transformed to symbols of things eternal. The leaf and flower, the rosy fruit and golden grain, the sun-painted plumage, the sky-inspired songs of the birds, all—all make life worth living and heaven worth the hoping."—H. C. Munson, in *The Warbler*, Old Series, Vol. I, No. 1, January-February, 1903, pp. 3-4.